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Contents.

	PAGE
Forthcoming Events	297
Semi-Steel Once Again	297
The Ninth French Foundry Congress	297
Correspondence	298
I.B.F. Elects New Members	298
Random Shots	298
Steel-Foundry Ladle Cranes	299
Catalogues Received	299
East Midland Foundry Developments	300
The Duties of an Engineer	300
Book Review	300
Sand Practice in Southern Foundries	301
Some Scientific Principles of Casting Metals	303
Foundry Activities in Sheffield	305
New Companies	306
Collecting and Assembling Technical Information	306
The Standardisation of Cast-Iron Gutters	308
Applications for Trade Marks	308
Trade Talk	310
Reports and Dividends	310
Contracts Open	310
Personal	310
Iron and Steel Markets	312
Students' Corner	312

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.

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"Parkhurst," Middlesbrough.

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Foundry Trades Equipment and Supplies Association.

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13 to 15, Wilson Street, London, E.C.2.

Secretary: K. W. Bridges, Grand Buildings, Trafalgar Square, London, W.C.2.

Welsh Engineers' and Founders' Association.

Secretary: E. J. Griffiths, 20, Fisher Street, Swansea.

Forthcoming Events.

Institute of British Foundrymen.

OCTOBER 31.

London Branch (Junior Section):—Opening meeting at 49, Wellington Street, London, W.C.2. Address by Miss M. D. Pittuck (Chairman) on "The Work of an Agricultural Research Station," also a short Paper by F. C. Cummings on "The Wadkin Universal Patternmaking Machine."

NOVEMBER 1.

Lancashire Branch:—Ordinary meeting at Manchester. Open discussion on "Foundry Problems."

NOVEMBER 6.

Sheffield and District Branch:—Works visit to Staveley Coal & Iron Company's Colliery, Staveley.

NOVEMBER 7.

Birmingham, Coventry and West Midlands Branch:—Presidential address by D. Wilkinson.

NOVEMBER 8.

Wales and Monmouth Branch:—Ordinary meeting at Cardiff. "Nickel in Cast Iron," Paper by W. T. Griffiths, M.Sc., F.I.C.

Scottish Branch:—Ordinary meeting at Glasgow. "The Moulding and Casting of Bronze Plates," Paper by Robert Liddle.

NOVEMBER 11.

Lancashire Branch (Burnley Section):—Ordinary meeting at Burnley. "Some of the Aims and Objects of the Institute of British Foundrymen," Paper by R. W. Stubbs.

Semi-Steel Once Again.

In view of the great interest aroused throughout the trade, we think it is desirable to summarise the pros and cons of the semi-steel question, as given in the recent article by "Vallishe," in our editorials and in letters from correspondents.

As to the name, "semi-steel" is clearly open to objection, because it implies in the mind of the user a material having properties half way between those of cast iron and those of steel. In fact, it has nothing of the kind; it has no ductility, and is really a cast iron. We therefore prefer a designation such as "steel-mix cast iron," and cannot agree with "Vallishe" that the distinction between the two terms is too fine to bother about. Then as to the effect of steel additions, some of our correspondents evidently look forward to some sort of official definition of semi-steel indicating what proportion of steel must be added to qualify for the title. Nothing seems to us more unlikely. It is a basic principle with the British Engineering Standards Association that the properties of a ferrous metal can be defined in terms of mechanical tests. Chemical composition, when mentioned at all, is merely given as a guide to indicate to the maker what composition might be expected to yield the mechanical tests which form the specification. The nature of the raw materials employed or the methods or processes adopted are never mentioned at all. They should have no interest for the buyer, and in our opinion the founder creates a dangerous precedent in accepting an order specifying what he shall put in his mixtures.

When the buyer specifies a given steel percentage he probably does so because that mixture has been found satisfactory in service. In all probability it would have been equally satisfactory to work in terms of the mechanical or physical tests. The system of specifying mixtures is weak, for the reason that would foredoom to failure any attempt to standardise semi-steel mixtures in terms of a given steel addition. Different foundries with the same steel addition would not necessarily produce the same mechanical or physical results, because the other conditions affecting the issue would not be the same. On the other hand, any foundry can readily adjust its mixtures and methods to produce a given mechanical test.

We submit, therefore, that the buyer as such is not concerned with mixtures, and that he should base his requirements on proved results. We think that a foundry should be free to use steel or not according as the requirements demand without having its hands tied, and that it should label its special materials with a special name. If the mechanical or physical properties of the metal are known, it is quite unnecessary to know whether the mixture contained steel and how much; hence the problem of determining this in a casting specified as semi-steel does not arise. Neither will founders be bothered by demands to use steel in castings the nature of which makes it desirable that steel should be left out.

We propose to reserve for a further editorial final comments on this question.

The Ninth French Foundry Congress.

A meeting of the International Committee of Foundry Technical Associations gave us the opportunity of attending in person an ordinary annual conference of the French Foundry Technical Association. The numbers were not large and were to some extent swollen by the delegates to the International Committee, yet the attendance at the last session was the same as for the opening. There was an air of keenness pervading the meeting, but we received the impression that the majority of Exchange Papers do not give rise to a real discussion as do those prepared by nationals. It is exactly the same in Great Britain, and, with few exceptions, they have been accepted extremely cordially but without discussion. Another phase common to most of these meetings is that one can say beforehand almost definitely who will discuss each Paper. Too much time is usually given to the presentation of each Paper, whilst too little organised effort is made to induce a real interchange of views. One of the most successful sessions ever held was conducted in Leicester by Mr. Lambert, when every person present was asked in turn to contribute his views. On this occasion the sessions each partook of a special character in order to attract for a couple of hours the members versed in that particular phase. This necessitated four sessions, and a minimum of ten hours was devoted to the real business of the gathering. This compares with a matter of four to six hours in our domestic congresses. It does seem to us that the holding of only one conference a year which must necessarily have an important social side, does limit too severely the presentation and discussion of Papers, and the best interests of the industry would be served by a second meeting, held annually, in London, which would be virtually free from social activities.

The conference finished with the holding of a banquet on the Saturday night, where Mr. Vansetti took the opportunity of announcing details of the next International Congress, to be held

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in Italy next September. He presented each person with a booklet containing the provisional programme. The year after, the French are to organise their third International Conference at Paris instead of Germany, who will take on this responsibility a few years later. This French congress will enjoy the patronage of the American Foundrymen's Association, and be counted in the fourth of the series, the first being in Paris, the second in Detroit and the third in London.

Correspondence.

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

Costs of Production of Good Cast Iron.

To the Editor of The Foundry Trade Journal.

Sir,—In your issue of October 16 a correspondent, calling himself "Riley," states: "*I know some foundries make what they call semi-steel as cheap as grey iron, but it is definite that, to get the results required, the method is more expensive than producing grey iron.*" This is not the case in any foundry under the writer's control nor in any of the many German foundries visited by him earlier this year. Maybe "Riley" uses very little coke for foundry grey iron or very much more for semi-steel; or it may be that, in his district, steel scrap is more expensive than either scrap iron or common pig. However, the writer is familiar with the contention that semi-steel is more expensive than plain cast iron, and it would appear to be a subject which should be ventilated. Of late years it has been the writer's good fortune to save several foundries considerable sums of money on their annual expenditure upon raw materials, and there must be many thousands of pounds spent needlessly every year by foundries using costly materials for purposes where far cheaper ones would answer as well or better. This applies, particularly, to those foundries making special castings—Diesel, automobile, locomotive, etc., etc. The writer has yet to see the quality of cupola-melted cast iron which cannot be produced from ordinary pig-irons and hematites, plus steel and iron scrap as required. Many foundries who claim to run upon economical lines are throwing money away upon expensive raw materials which could be done without. "Riley's" statement, however—as given at the beginning of this letter—is very definite and may have nothing to do with raw materials but, instead, may depend upon some procedure of his own when dealing with mixtures containing steel. It is impossible to criticise without knowing the whole facts, nor can one give away for nothing a life's experience, but in this case, if "Riley" chooses to put his figures in confidence before the writer, he will gladly see if it is possible—without disclosing information which others are paying for—to tell "Riley" whether the high cost of his semi-steel is a matter which could be remedied or whether it is one of those exceptional cases where nothing can be done.—Yours, etc.,

Horace J. Young.

3, Central Buildings,
Westminster, S.W.1.
October 21, 1930.

Mass and Skin Effects in Cast Iron.

To the Editor of The Foundry Trade Journal.

Sir,—A careful study of the test results which you published in your issue of January 30, 1930, prompts the following explanation of the apparent anomalies which Dr. H. W. Swift established with regard to tensile tests.

Dr. Swift found a quite definite relationship between diameter of bar and tensile strength varying from 14 tons per sq. in. for a ½-in. bar to 6½ tons per sq. in. for a 3-in. bar, when he tested the bars as cast without machining and all tested with the same distance between grips. When the bars were machined the relationship was not so definite. The report states that in the later tests some of the test-pieces were turned down from short lengths, but that with a material like cast iron there appears to be no objection to such procedure.

On the contrary, the whole mystery might be solved by examining the effect of reducing the length together with the possibility of the metal at the centre of the casting possessing a slightly differing stress-strain relationship. The conception is most simply explained by saying that if a test bar of soft indiarubber instead of cast iron, 3 in. dia. by 6 in. parallel length (exactly as used in some of the reported tests), were pulled, a concavity would be formed at each end by the loading. Dr. Swift's results establish precisely the same effect with cast iron, though to a far smaller extent. He applied a load to the skin of each test-piece. That load was transmitted by shear force towards the centre of the bars.

It is quite possible that in the case of a 3-in. dia. bar, only 4 in. between grips, the skin will stretch to breaking point without the centre being stretched at all. In the case of a ½-in. bar about 8 in. between grips, the shear effect would be by comparison hardly noticeable. In the absence of complete data it is impossible to attempt any real calculations, but it should be possible to develop an approximate method if further tests were carried out on the same grade of cast iron. Even without such further test data it is probably safe to say that there might be a 1-in. dia. hole along the axis of a 3-in. dia. test-piece (4 in. long between grips) without reducing the total load required to break it.

This would provide one method of checking the foregoing conception. Another way would be to test various lengths of the same diameter. As a rough approximation the 3-in. dia. bar would probably require 14 tons per sq. in. to break it, if it were feasible to pull a length of 48 in. between grips.

Evidence is gradually accumulating that the development of a rational theory of stress computation for cast iron in particular and for materials in general which do not obey Hooke's Law can only take place when research starts once more from first principles free from the deadening influence of the "straight-line" mathematical theory of elasticity.—Yours, etc.,

A. C. Vivian, Assoc.M.Inst.C.E.

Middlesex.
October 20, 1930.

I.B.F. Elects New Members.

In our issue of October 23 we printed a list of those gentlemen who had been elected members of the Institute of British Foundrymen at a General Council meeting held at the Bell Hotel, Gloucester, on October 18. The following is a late additional list:—

As Members.

H. C. Heggie, metallurgical chemist, H. C. Heggie, Avenue Road Laboratory, Aston; Chas. Heggie, director, Brookes, Limited.

As Associate Members.

S. Batty, draughtsman, J. W. Jackman & Company, Limited, foundry engineers, Salford; E. M. Currie, foundry engineer, A. Herbert, Limited, Coventry; D. Galbraith, draughtsman, Argus Foundry, Limited, Thornliebank; T. E. Gough, engineers' patternmaker, Belliss & Morcom, Birmingham; A. L. Mortimer, coremaker, Argus Foundry, Limited; H. F. Mackenzie, foundry manager's assistant, Belliss & Morcom; A. M. S. Patterson, iron moulder, Jackson, Elphick & Company, Larkhall; W. M. Pereira, iron moulder, Babcock & Wilcox, Limited, Renfrew; L. W. Rigby, foundry engineer, J. W. Jackman & Company, Limited, Vulcan Works, Manchester.

Random Shots.

A famous dramatist declared recently that youth to-day sows its wild oats just as it always did, but that the oats are of much better quality. Does that mean that the crop is larger?

* * *

The Motor Show manages each year to get an extraordinarily good Press. It is amazing how the papers combine to make the Show a news feature. Justifiably, of course. Britain now produces the cheapest four-, the cheapest six- and the cheapest eight-cylindered cars.

* * *

In view of a most charming and appreciative letter from a valued American correspondent, which my native modesty will not permit me to quote, I would like to finish what I heard about American conditions recently by a reference to the extraordinary extent of what my friend called the hotel industry. The modern American hotel is a steel structure built round an elaborate and standardised plumbing system, for every room has its private bath and other accessories. Many provide radio sets (I gather the gramophone is completely dead there), and laundry service is swift and extraordinarily efficient. Thus in most hotels laundry surrendered by 9 or 10 a.m. is returned the same evening. Features of the best hotels are astonishingly quickly copied by the lesser ones, because the American traveller expects the same service from all.

* * *

The working principle is that there must be no restrictions on the client. He can come and go as he pleases at any hour of the day or night (he never has to ring the bell to get into a dimly-lighted vestibule after 11 p.m.), and can get a meal at any time. My friend found that while young Americans like Paris, older ones invariably preferred England, and that the United Kingdom would find American visitors a gold mine if they were properly handled. We must get out of our habit of regarding them as peculiar because they drink ice-water and like relatively high indoor temperatures. They really dislike drinking lukewarm water or even beer. Most beverages drunk in England are never really cold.

* * *

The ice industry in this country is in its infancy. They do not dislike our food—although they do sometimes much dislike the way it is prepared. (Incidentally, it has much more flavour than most American food), but they do like cereals, salads and fruit.

* * *

Of course, American hotel charges are high, but the service rendered is such that they are paid with something approaching resignation. It will be interesting to see if the Canadian Pacific Railway proceeds with its scheme for building a large hotel, on American lines, for its tourists in the West End. It may become popular with Britishers!

* * *

I stayed recently at an English seaside hotel. It was about 80 years old. I hope it pays, but I am afraid it doesn't. Its Victorian atmosphere, plush curtains, string beads, antimacassars, over-upholstered furniture and heavy bedroom suites, with sticking drawers, unworkable locks and useless hasps, aroused a steadily accumulating resentment that will prevent not merely the hotel but the resort ever seeing me again. Of course, its bedrooms were devoid of running water, and, what seems to an American the elementary decency, of a bath, involved setting in motion as much effort as would normally produce a Cochran revue. To think that we taught the Continent modern sanitation!

Marksman.

Steel-Foundry Ladle Cranes.

In the field of foundry and steelworks cranes, long prominent have been Messrs. Craven Bros. (Manchester), Limited, of Reddish, Stockport, and we are able to give some interesting details regarding one of their recent 100-ton overhead electric-driven steel-foundry ladle cranes of the 5-motor type. This also allows of an auxiliary lift of 20 tons, with in each case a test load of 25 per cent. above the maximum, the span being 58 ft. 4¾ in. As regards the speeds, the main lift (100 tons) is 8 ft. 6 in. per min., the auxiliary lift 24 ft. per min., the cross traverse main crab 80 ft., the cross traverse auxiliary crab 100 ft., and the longitudinal travel 175 ft.

The five motors, 220 volt D.C., running at 550 to 600 revs. per min., are 100 h.p. for the main lift, 50 h.p. for the auxiliary lift, 25 h.p. main cross traverse, 15 h.p. auxiliary cross traverse, and 50 h.p. longitudinal travelling, each of these motors being independent of the others, both in speed and direction. With regard to some of the constructional details of the crane, all the gears have machine-cut teeth, the pinions being of forged mild steel and the wheels of cast iron or cast steel, while special attention is given to shaft bearings and lubrication. The cross girders are of the strutted Warren type, constructed of best-quality mild-steel channels, plates and sections, with bridge-section rails riveted to the top flanges. In essentials the design is two main girders carrying the 100-ton trolley and two secondary girders for the 20-ton auxiliary trolley, all the girders running independently clear through from end to end to the strong-braced framework, from which they are suspended. Further, a supplementary girder is provided to carry the longitudinal travelling gear on one side, as well as the driver's cage. Particularly important is the method used for supporting the rail on the main girders, which is carried direct on a girder of joist formation, which runs from end to end of the span, and is itself supported by suitable brackets at each vertical and each panel point. The result is a perfect support for the rail, with entire elimination of sagging. Also the four carriages are of strong and heavy construction, each fitted with two fixed steel axles, while the driver's cage has a foot brake to control the longitudinal travel without the necessity of suddenly reversing the motor.

The main-crab framework is of similar robust construction, carried on four double-flanged steel-tyred wheels, and the hoisting-lowering motion is worked by two strong cast-iron barrels, one at each end of the crab, both driven from the one hoisting motor, while the auxiliary crab is on somewhat similar lines. A characteristic feature also in each case is the provision of a "Craven" patent automatic-limit switch of the quick-action self-replacement type, to prevent overwinding and overlowering of the lifting hook. Further there is included for each motor shaft an automatic magnetic brake of the "clip" type applied by gravity only, quite independent of springs, always liable to fail at the critical moment, which comes into action instantly should the current fail, holding the load easily. Altogether the design (Fig. 1) is a fine example of British engineering in overhead cranes, especially as regards heavy foundry work, whilst the firm also specialises on overhead cranes for iron foundries.

Fig. 1.—The "Craven" 120-ton Steel-Foundry Ladle Crane of the 5-Motor Type.

Catalogues Received.

Rotary Furnaces.—We have received from the Brackelsberg Melting Processes, Limited, of Malaya House, Charing Cross, London, S.W.1, a 12-page pamphlet, which describes and illustrates the Brackelsberg rotary furnace. This furnace is probably the best known of all rotary pulverised-fuel-fired furnaces, and is characterised by the use of flame of such velocity that the ash is carried right through the furnace and thus does not contaminate the slag and metal. In addition to a rotary motion, the furnace tilts for lining, charging and (slightly) for tapping, a feature rightly stressed in the brochure. There is a general trend in the booklet to emphasise the characteristics of the product, due to the actual process, and some really interesting results are detailed. We cannot stress too strongly that, with the development of better-grade cast iron, this type of furnace shows great potentialities for meeting modern requirements, and foundry owners would be wise carefully to collect all the data they can. The only inherent advantage of the cupola over modern furnaces, such as the pulverised-fuel-fired rotary furnace or electric melting plants, is that it can give a continuous supply of metal for the continuous casting. However, by a system of duplexing even this can be largely imitated. The pamphlet is available to our readers on application.

Rotary Furnaces.—We have received from Messrs. Pittevil & Company, of 22/23, Laurence Pountney Lane, London, E.C.4, a brochure outlining the technical advantages of the Sesci furnace. The furnace utilises powdered fuel, containing only 5 to 15 per cent. of volatile matter, and operates under short-flame conditions. High temperatures are obtained by a system of recuperation, which preheats the air. The progress which this furnace has made is disclosed by the guarantees given in respect to fuel consumption, melting times and casting temperature. Charging is done by a vertical charging machine, after pushing the exhaust box out of the way. The tapping hole is situated centrally in the barrel part of the furnace. We notice that the furnace capacities are provided for one, two, three and a half, five and ten tons. Our furnace experience points to the following range as being more generally suitable:—10 cwts. (if possible), 30 cwts., 3 tons, 5 tons and 10 tons. However, only years of experience will settle this question, and even then some foundries will demand intermediate capacities. The pamphlet contains 12 pages and carries half-a-dozen well-chosen illustrations. We strongly recommend our readers to make themselves thoroughly *au fait* with rotary-furnace developments, as they appear to present great potentialities.

Elevators and Conveyors.—We feel reasonably certain that the average foundry owner does not realise the considerable number of types of conveyors placed at his disposal by the specialised manufacturer. We are often nauseated by the constant reiteration of the false statement that because of the abrasive action of sand, conveyors are useless in foundries. Thus we welcome the receipt from Messrs. Bagshawe & Company, Limited, of Dunstable, a 48-page, well-illustrated catalogue, which unobtrusively and in a most interesting manner takes the reader through the whole range of plant available. Gravity rollers are shown doing duty in foundries, breweries and motor-car works. This is followed by illustrated descriptions of the swing-tray elevators and conveyors, followed by the slat or platform type for core ovens. Amongst special-duty conveyors illustrated, yet of interest to the industry, are those designed for carrying castings through pickling tanks. Portable conveyors are shown incorporating buckets and belts as the motive parts. Quite a number of applications are illustrated of bucket elevators, scraper and belt conveyors. Pendulum conveyors for handling fragile cores, as is well known, require special treatment. Even water channels have been suggested! In this direction, however, the Bagshawe concern has been particularly successful.

We have just one suggestion for the improvement of this catalogue. The issuing firm has wisely detailed the essential particulars for helping buyers to frame their inquiries so as to minimise correspondence. Yet we believe that better service would be given by converting these into a tear-out *questionnaire*. The only objection is that provision for one inquiry only would be made.

Non-Ferrous Metals and Alloys.—A 90-page well-illustrated catalogue, received from Hüttenwerke C. Wilh. Kayser & Company—Niederschöneweide A.-G., 6/7, Spree Strasse, Niederschöneweide, Berlin, details a very extensive line of non-ferrous metals (copper) and alloys (bronze, tin, lead, type metal and the like), which they manufacture in their works at Oranienburg and Lünen.

East Midland Foundry Developments.

PROGRESS IN APPRENTICESHIP TRAINING.

The East Midlands Branch of the Institute of British Foundrymen held the opening meeting of its 1930-31 session at the Loughborough Technical College recently, when Mr. T. Goodwin delivered his Presidential Address.

PRESIDENTIAL ADDRESS.

In the course of his address, Mr. Goodwin said that whatever ideals might be the objective of the Institute, actual conditions were bound to assert themselves, and its operations naturally became very practical and self-centred. In the case of the Institute, the progress of the art concerned was the expression of ideals, knowledge and experience of the members of the Institute in all that appertained to the practice of the foundry art, and was the principal concern of the Institute, the objects being clearly defined on the emblem of the Institute in the following words: "To promote the intellectual welfare of its members by periodical meetings for reading and discussing scientific Papers on subjects connected with the foundry and allied industries and such other matters as might be considered within the scope of this special authority." They took it then that one of the objects of the Institute was to raise the status of the foundry industry. In the past this had been placed very low in the scale of achievement and recognition. The lack of appreciation of the value of the foundry by members of the engineering profession was deplorable. The very rigorous standard which the engineer had set up, without, in many cases, consulting the pattern shop and foundry whether it was possible to produce a sound casting from their design, he felt demanded very severe criticism.

The foundry industry, he said, must first realise its importance, and then insist on proper treatment. Circumstances such as a period of bad trade were often the cause of undercutting of prices, and were taken advantage of by a certain class of buyers. He mentioned that he knew of a certain buyer who was always boasting that he was going to place contracts at his own figure. However, Mr. Goodwin happened also to know of two or three firms who had turned him down by having refused to make the goods at the figure which he quoted.

Value of Short Paper Competitions.

After referring to the ideals and objects of the Institute, he emphasised the value of every member. It depended on his capacity, and his personal influence and experience. He appealed to all members, and especially the younger ones, to take part in the discussions of the Papers read at the lectures. Looking back over the years he had served on the Council, he said he had noticed the difficulty there had been to induce members to take part in the discussions. The Council was anxious that the members should take a more lively interest, and he was convinced the inauguration of the short Paper competition by Mr. Stevenson, of Nottingham, who was one of their past-Presidents, was the best step which had been made in the encouragement of members to express their ideas. The competition had given the opportunity for the members to raise and discuss questions affecting the general well-being of the members and the importance and status of the Institute. A further step might be considered. Before reading the Papers it might be arranged that on due notice to the Secretary a member could raise any point of general or local importance, under an enforced time limit, of course, both as to speaker and discussion. This would no doubt add new life and activity, more strength and vigour, to the actions of the members, rather than being mere sucklings awaiting mental nutriment and guidance.

Collecting Foundry Data.

It might, said Mr. Goodwin, be profitable to review some subjects for popular consideration; possibly too many subjects would arise. That, of course, was quite conceivable, but the trouble arising from excessive vitality would be welcome; serenity and inactivity were intolerable things. Certain matters might be suggested as worthy of immediate attention. Suppose all the members brought forward their own particular method of charging and working their cupolas, the well-being of the members and the foundry industry would be improved. The educational side of the foundry industry, so far as the East Midlands Branch was concerned, was receiving much attention. In Derby the Sub-Committee composed of Messrs. W. T. Evans, C. W. Brigg and H. Bunting; the secretary, acting in an advisory capacity with Dr. Richardson, the Principal of the Derby Technical School, had been very busy, and much good should accrue from their labour. Mr. A. E. Peace and Mr. Phil. Russell had been elected to serve on the new Technical Committee. In Leicester and Nottingham also everything possible was being done to encourage the foundry student. Loughborough was well catered for; it had the facilities, the teachers and the students. The works training of the students, while directly out of the control of their members as a whole, was, however, largely in the hands of individual members. There were many cases in which members could exercise a dominating control both in works and technical training of their juniors. There was a great opportunity for the student to-day, if only he would grasp it. Many men had risen, and men were still rising, in the foundry industry by their own native genius, but the best positions in the future would be filled by the men who had the highest degree of skill, intelligence and technical experience.

In conclusion, Mr. Goodwin emphasised the fact that each member had imposed on him the duty of active participation in the operations of the Institute, particularly in the training and guidance of the juniors in the industry.

Carbon in Iron and Steel.

A highly technical Paper on "The Rôle of Carbon in Iron and Steel" was given by Dr. Bramley, of the Loughborough College, who was afterwards accorded a vote of thanks, on the proposition of Mr. Stevenson (Nottingham), seconded by Mr. T. A. Spiers (Leicester), both of whom remarked that the subject was too highly technical to discuss.

Mr. Spiers said the subject was "far and above" him; in fact, he had given up the attempt long ago, as it was so difficult.

It was agreed to have a further address and a discussion on a future date.

Dr. Bramley said one point that had struck him about foundry work was, that if a parent had a son whom he was desirous of placing in an engineering works, the first thought had been to get him in the drawing office. If unsuccessful, the next place was the pattern shop, and in turn the fitting or turning shops, and if he could not manage any of those, then it was a case of having to go into the blacksmith's shop or the foundry. "It seems to me that the foundry is the cinderella of the engineering industry," he said. It required a higher and more extensive and better education to produce a competent foundryman. Not only did he require to know something about drawing and pattern making, but what was required of the castings after they had been made. He must be a first-class metallurgist. It was a case of knowing the work of two men before he started with his own. That was what was required really to understand the work. The trouble to-day was that they had a lot of poorly educated boys in the foundry; they went into the foundry when they could not get anywhere else.

Mr. Goodwin said there was a certain amount of truth in what Dr. Bramley had said.

A vote of thanks was accorded the chairman at the close.

The Duties of an Engineer.

In the course of his Presidential Address to the Institute of Mechanical Engineers, Mr. Loughnan St. L. Pendred concluded with a spirited appeal for enterprise and culture. Here are his actual words:—What I have been endeavouring to do is to stir up a spirit of courage and adventure amongst our members. All around us we see new methods springing up and the infallibility of old laws and old beliefs being challenged. Something should come out of it all, and I hope our own young British engineers and scientists will give rein to their thoughts, and the spur to their activities. There is no nation which has the mechanical engineering instinct so highly developed as our own; there is none which has a finer record, carried down to this very day, in science and technology. It is not boasting, but real conviction that makes me say we are capable of anything. I know the great difficulties that exist at the moment, but they will pass. The world cannot do without mechanical engineers; I am confident that within a very few years, when the nations have adjusted themselves to the new conditions, there will be work for all who have brave thoughts and the courage to prosecute them.

There is one direction to which I would ask you all to look. Mechanical engineers have supplied all the peoples of the earth with marvellous inventions, but we must admit that many of those inventions are imperfect. We poison rivers with effluents, charge the atmosphere with noxious fumes, jar the nerves with vibrations, deafen our ears with noises, and offend our eyes with ugly factories and a countryside destroyed by our activities. I can imagine no more beneficient work for the engineer and the scientist than the removal of all those things which still mar the great and wonderful work they have done. May all of you who are coming on to the field that we are leaving carry our work a step further towards a larger and greater efficiency than we have ever known, and remove the defects of applied science without diminishing the great benefits which it has conferred upon mankind.

Book Review.

Builders' Materials, by R. F. B. Grundy, B.Sc. Published by Messrs. Longmans, Green & Company, Limited, 39, Paternoster Row, London, E.C.4. Price 5s.

This excellent little book covers timber, stone, bricks, iron, steel and non-ferrous metals, lime, gypsum and plasters, cement, concrete, glass, roofing materials, paint, varnish and distemper. Some of the information given about iron and steel is not quite correct, but, after all, a builder does not need much more than a superficial knowledge of the manufacture of the materials he uses. We can thoroughly recommend the book, for filing for reference, when called upon to carry out repairs and extensions to one's shops without calling in outside contractors.

Sand Practice in Southern Foundries.

LONDON DISCUSSION REVEALS DIVERGENT VIEWS.

Last week we published a comprehensive Paper by Mr. J. L. Francis bearing the caption "Some Practical Notes on Foundry Sands." Below is a *résumé* of the discussion, in which the results of long practical experience were exchanged. It was opened by Mr. A. F. Gibbs, the Branch-President, who, after thanking the author for his Paper, said it seemed to him that there were splendid opportunities for the suppliers of sand to supply the foundries with a sand which would need no supervision. He did not know whether they could do that yet, or whether the founders would be prepared to pay the price that might be demanded for it, but he hoped that, if it could be done, the price would not be too high. It was apparent that the time was coming when the founders of this country, as well as abroad, would have to use synthetic sand, and when that time came the founders would be more than ever in the hands of the sand suppliers. He believed there was on the market an apparatus for measuring the moisture content of sand, and that it was used in some of the larger foundries, in which a good deal of machine moulding was carried out.

With regard to permeability, he said that, arising out of a Paper by Mr. van Aarst, of Holland, Mr. Presswood had stated that permeability was of no importance if dry moulds were coated with plumbago. As to the addition of coal dust, he expressed the view that very often this was resorted to unnecessarily in the foundry; he could not see that there was need for the addition of appreciable amounts of coal dust in dry-sand moulds There would be a certain amount of gas evolved from it; that led to the question of whether or not the hydrocarbons evolved did form a cushion between the metal and the sand and enabled one to produce a clean casting.

Heavy Mullers and Sand Depth.

Mr. C. H. Kain drew attention to two statements in the Paper which appeared to be contradictory. The first of these stressed the view that it was dangerous to use heavy mullers, and that view was accepted fairly widely—though he personally did not altogether agree with it. The second statement was to the effect that Mr. West, of Leyland Motors, had found that when milling oil sand in a mortar mill there was no appreciable crushing of the sand grains. An oil sand—which presumably was built up from a pure silica sand—was far more liable to be crushed than was an ordinary moulding sand, and, therefore, Mr. West's experience seemed to dispose of the argument against the use of a heavy muller. Mr. Kain was of opinion that the argument against the heavy muller was based on a wrong principle. In his view the factor which really mattered was the depth of sand under the muller. If a heavy muller were running round in a mill and had only half-an-inch depth of sand beneath it, it would pound out the sand and create a quantity of silt, but if there were a good depth of sand beneath the muller one would achieve quicker milling, and, he claimed, there would be no appreciable crushing of the sand grains.

Powdered Clay Additions.

Commenting upon the statement made in the Paper that it was very desirable to dry sand before milling, he asked if the author had practised that and, if so, if he had experienced trouble—after the sand had been milled and remoistened and applied to the mould—due to the mould face drying off and becoming crumbly and washing away when the metal was poured into the mould. The same question arose in regard to the addition of clay in the form of a powder. His experience was that if it were added as a dry powder and moistened in the mill, although the resulting mixture might be satisfactory for the making of a mould, the mould face dried off very quickly. On the other hand, it was his experience that if the clay were added in the form of a slurry it was necessary to use so much water in the slurry that the mixture became definitely unusable. If the amount of water added were only just sufficient to make a slurry which, if it could be milled into the sand, would make a moulding mixture dry enough to be usable, the clay was so adhesive that it adhered to the mullers, and the result was a most unsatisfactory bond.

Hot Mixing Advocated.

Mr. H. G. Summers, who asked for more information with regard to the use of coal dust in cores, said he had been in the foundry for about 28 years but had never used coal dust in cores. In green-sand moulding he used it as a facing. If it were used in a core mixture it weakened the core and did not serve the purpose for which it was added. With regard to heavy mullers, he considered that their use was necessary and was not detrimental; it was the quantity of sand to be milled that determined the weight of the muller. Discussing the mixing of old sand with new sand, he suggested that the best results were obtained by mixing immediately after the hot castings had been shaken out of the moulds—when the old sand was practically steaming—and leaving the mixture to stand overnight ready for use on the following morning.

A Question of Proportions.

Mr. R. B. Templeton, commenting upon the author's statement that, when mixing sands, the proportions he used were three of old sand or floor sand and one of new sand, said that he had been told recently, by a representative of a firm which was selling a very modern plant, that proportions of 12:1 would be quite satisfactory. Much would depend, of course, upon the condition of the floor sand used, but he asked for the author's opinion as to whether it would be possible to use such a mixture in practice as a facing sand.

Micro-Cracking and Moisture Distribution.

Mr. V. C. Faulkner (Past-President of the Institute) said the author had not mentioned that unevenness in the moisture content of a sand-facing mixture could result in variation of the cooling conditions as between different portions of the casting skin; if a portion of the mould contained a larger amount of water than the rest of the mould, the iron in contact with it would cool a little more quickly than the remainder, with the result that microscopic cracks might occur. That was an extremely important feature, and one which probably influenced the quality of the skin of a casting. Discussing the author's reference to the desirability of drying all sand when it was received at the foundry, he said that that practice had been followed in the Ardennes regions for many years, and had been emulated in some of the foundries in the Midlands of this country which had a national reputation for quality of surface. With regard to moisture, he said that in one of the foundries in Scotland a moisture meter was used for the checking of the moisture content of the sand, and had been found to minimise the percentage of wasters ascribable to uncontrolled water content. Unfortunately, the machine was of American origin, and, inasmuch as there was an import duty imposed on scientific instruments, it was expensive in this country.

Size of Coal Dust Determinative.

Mr. G. C. Pierce (Past-Branch-President), discussing the use of coal dust in facing sands, said that the most important point was not the quantity of coal dust but the size of the grains of coal dust. For example, if one were producing castings 1 in. thick one would use a certain amount of coal dust in the facing sand; if the same amount of facing sand were to be used to produce castings 0.1 in. or 0.15 in. thick, approximately the same volume of coal dust would be needed, but it was obvious that its grain must be much finer. The Paper as a whole, he added, spoke volumes for the accuracy with which the moulders of the past had mixed their facing sands—and he was reminded that, in the past, it was a common occurrence for a moulder to be "shown the gate" if he made a casting with a scab on it.

A Contrast in Sand Cost and Production.

Mr. J. W. Gardom (Past-Branch-President) said that in recent years Papers on sand and sand preparation had been more frequent than they had been in the past, and more attention was being devoted to these matters, because of the adoption of more scientific principles than were formerly applied in the foundries. He agreed with Mr. Pierce that the moulders of the past had made excellent castings, but the cost of the sand used represented only about 1 per cent. of the selling price of the finished casting, and the foundry owners had not been very particular, therefore, as to whether a moulder used a 12:1 mixture or a 3:1 mixture; even 2:1 mixtures could be used, and it had been the practice of many moulders to go to the sand pile and more or less mix their own sands, which they had done very well. We had now reached a stage at which foundries were being run mechanically, with the result that the moulders' production had been increased about 300 per cent., and the cost of sand preparation represented about 25 per cent. of the moulders' cost, so that sand was becoming a much more important factor. Again, in a mechanically-run foundry the sand must be delivered to the moulders already prepared, and the preparation must be definitely fixed as being suitable for the castings being produced, and must not be altered by any individual moulder; therefore, very careful thought must be given to its preparation. For those reasons, Mr. Gardom was grateful to Mr. Francis for having put forward in his Paper the results of a very careful and thorough study of the sand problem—a problem of vital importance to the future success of the founding industry.

Factors affecting Blending.

Mr. A. S. Beech said that although the author had emphasised the importance of the preliminary drying of new sand when it arrived at the foundry, no mention had been made of the reason why the foundries in the Ardennes and some of the foundries in the Midlands produced castings having much better skins when they mixed old sand with dry new sand than when they mixed both the new sand and the old sand in the damp condition. The reason was that with any mill, no matter of what type, it was very much easier to incorporate or mix dry sand with damp sand than to mix two damp sands together. With regard to the weight of mullers, he said that a few years ago it had been accepted widely that it was very much better to use lighter ones than the heavier ones. A more important point, however, was the depth of the sand and the action of the sand beneath the muller; if the depth of sand were too great the action of the muller affected only the top and bottom layers of the sand, and the sand in the centre was not properly mixed. What was required was a definite rubbing action on the sand.

Experientia Docet.

Mr. J. Bartram pointed out that the proportion of old sand to new sand in a mixture depended upon the nature of the casting to be made. One could not adopt the same practice in making a casting $\frac{1}{2}$ in. thick as in making one 4 in. thick. Similarly, in regard to the use of coal dust, the quantity and grain size must

be determined in accordance with the type and size of casting to be produced.

Mr. W. B. Lake (Hon. Treasurer of the Institute and Past-President of the Branch) expressed agreement with the remarks of Mr. Kain. He had always found that the mixing of two sands, or a sand and a binder, in a dry condition resulted in the mould drying off too rapidly. Perhaps Mr. Beech could suggest how that difficulty could be prevented. As to the suggested difficulty of getting sand sheeted, he said that all the sand of one particular size that he bought was delivered already dried and sheeted.

Use of Hot Sand Controversial.

Mr. J. R. Nunns congratulated the founders in the South of England upon having available local sands of such comprehensive application. One of its advantages was that moulds made with these sands could be patched considerably without being harmed. A trouble sometimes experienced in connection with the milling of sand, especially when heavy mullers were used, was that a careless attendant might allow the milling to continue several minutes longer than it should do, with the result that the sand came out of the mill in a caked condition and was then put into a disintegrator or aerating machine, after which it was supposed to be a good sand. The sands in the South of England did not require much milling in order to secure the necessary bond. Discussing the reference made by Mr. Summers to the use of hot sand, he expressed the view that a good many casting troubles had arisen from that source, and said he would not allow a man to mix hot sand with a facing sand.

Mr. Summers said he had not suggested that hot sand should be used in a mould. His point was that the sand should be mixed whilst hot and allowed to stand overnight, ready for use next morning; in that way a proper mixture was obtained, whether in summer or winter.

Sand Mixing and Casting Skin.

Mr. A. S. Beech, referring to Mr. Lake's remarks concerning the rapid drying of moulds and the consequent flaking, suggested that probably the trouble was due to the drying of both the old and the new sand before mixing, and that if the new sand were dried and then incorporated with the old sand in the damp condition the incorporation would be much better. It was very difficult to incorporate two dry sands, or two old sands in the damp condition. At one time he had mixed five parts of old damp sand with one part of new dry sand, and had obtained beautiful castings, with beautiful skins, from moulds made of that mixture. The same quantities of old sand and new sand were also mixed, both being in the damp condition, and the castings produced in moulds made of that mixture had not such a good skin as the previous ones.

AUTHOR'S REPLY.

Mr. Francis, after thanking the meeting for the kind reception accorded his Paper, replied to the discussion. Commenting on the Branch-President's expression of the hope that the suppliers of sand would supply it to the founders in such a condition that little supervision would be necessary, he said he supposed that that could be done to a certain extent, but it must be remembered that the vendors of sand normally supplied only the virgin sand, so that the users would still have to prepare their mixtures in accordance with the conditions they had to meet. Therefore, testing and supervision would still be necessary at the foundries.

Moisture Meters.

Presumably the moisture meter referred to by Mr. Faulkner was the McIlvaine meter. He himself had not used one, but had seen one at a Foundry Trades Exhibition, and believed that its action depended upon the passage of an electric current through the sand, the principle being that the greater the moisture content of the sand the less the resistance offered to the passage of the current. Unfortunately, however, there were factors other than moisture in sand which affected the passage of an electric current, and for that reason he believed some difficulty had been experienced in the application of that moisture meter.

Dealing with the statement, attributed to Mr. Presswood, that permeability was of no importance in moulds, he said he considered that the only kinds of moulds in regard to which permeability was of no importance were those constructed of such material that no gases whatever were formed. Even in the case of castings produced in such moulds, however, one could not guarantee that there would never be any gases absorbed in the molten metal itself, although, of course, that might be a secondary consideration. In the case of die casting, or in permanent moulds or chill moulds, there was no permeability of the mould; the only possible means for the gases to escape were through the joints or artificial vents, and in die casting vents were provided. After all, the air that was in the moulds before the metal was put in had to get away.

Coal Dust.

With regard to coal dust, he did not think it was usual to employ it in dry sand; there was no need to use it in that case, because the dry sand was usually faced-up with some black wash in order to ensure a good skin and easy stripping. It was only in green-sand work that coal dust was essential. The problem of the use of coal dust was dealt with in some detail in a Paper read before the Institute at its 1929 Convention by Mr. Ben Hird, and in the discussion upon that Paper,* and Mr. Francis suggested that anyone requiring information on the subject should consult that Paper and discussion.

As to Mr. Kain's reference to the apparent contradiction in his (Mr. Francis') reference to the danger of using heavy mullers and the statement by Mr. West that for oil sand he had obtained the best results by using a mortar mill with mullers, he said he did not know whether the mullers used by Mr. West were heavy or light, but, in any case, in milling oil sand the lubricating action had its effect. If one were to mill dried sea sand with heavy mullers, he believed fragmentation would result, but when there was oil present in a sand it lubricated the grains so that they moved over one another more readily; even in the latter case, however, he believed that the use of mullers of excessive weight would result in crushing. He agreed with Mr. Kain that the thickness of the layer of sand underneath the muller was an important factor, but, in any case, he saw no object in using a heavy muller. He was unable to say off-hand whether or not a heavy muller would accomplish the end in view more quickly than a lighter one, but, after all, it was the sliding action of the sand grains that was necessary; for that reason the old-fashioned method was for the moulder to stamp on the sand and give his foot a twist. It was well to bear in mind that the mortar mills, adopted by the foundries for dealing with sands, were designed originally as brick crushers, and they were used by foundrymen because they seemed to represent the nearest approach to a machine which would fulfil their requirements.

With regard to the point made by Mr. Kain and Mr. Lake that the drying of the sand prior to milling resulted in too rapid drying of the mould face, Mr. Francis believed that if the sand were submitted to a temperature much above 100 deg. C. when dried, that fact would have a very important bearing upon the results, because by the use of temperatures greatly above 100 deg. C. one was likely to drive off not only the hygroscopic water but also the chemically-combined water. Once that had been done in the case of clay, for example, there was no guarantee that the material would be restored absolutely to its original condition.

Mr. Lake remarked that that matter had been taken care of.

Mr. Francis, referring to the addition of clay to the mixture, said that it was Lemoine who had obtained better results when adding it in the form of a slurry than when adding it in the powdered form. Apparently, however, Mr. Kain could not get good results either way, so that, presumably, he did not advocate its use at all.

As to the use of coal dust in cores (mentioned by Mr. Summers), he had not referred to it in the Paper, but he supposed that coal dust was present in green-sand cores. He had no experience of the mixing of sand when hot, and, therefore, could not comment upon it.

The proportions of the different sands used for mixing facings, of course, depended very greatly on the sands, the castings and the metal used to make the castings. In some cases, he believed, it was possible to use all floor sand and no facing at all.

It was true, as Mr. Faulkner had pointed out, that there were good deposits of natural sands in Europe, so that, generally speaking, the sand problem was less difficult here than in America, but even in this country there were foundries which were fairly remote from the deposits, so that the transport-cost problem was one of importance to them. For example, his foundry used Leighton Buzzard sand for oil sand, and, although it cost only a few shillings per ton at the quarry, it cost nearly a pound per ton delivered at the foundry. He had examined the sand from Ardleigh, in Essex, and had found it was very good sand; it was delivered by motor lorry much more cheaply than the sand from Leighton Buzzard. Again, it must be remembered that, although we had deposits of good natural sand, it was not always consistent, because the strata altered. If one ordered sand every three months from Erith, for example, one would not necessarily obtain sand from the same strata each time, because in the course of three months he supposed thousands of tons of Erith sand were removed, and it was well known that the grain size of Erith sand was becoming finer and finer as more of the sand was quarried.

The point raised by Mr. Pierce, that the grain size of coal dust was more important than the quantity used, was extremely important, and he had mentioned it in the Paper. To illustrate the point, he said that, if the grain size of sand were one-eighth of a millimetre, there would be 500 grains, and approximately 500 pore spaces, per cubic millimetre; that meant that about 500 particles of coal dust could be accommodated; assuming there was one for each space, that meant that there were 500 grains of coal dust of, say, 0.055 mm. dia., which worked out at about 4.5 per cent. of the sand bulk.

Cost of Sand and Waster Bill.

Commenting on Mr. Gardom's remark that the cost of the sand had represented, in the past, only about 1 per cent. of the selling cost of the casting, he said we must not lose sight of the fact that the important point was not so much the cost of the sand as the cost of the waster castings which might result from the improper use of sand. If a casting were wasted and had to be reproduced, not only was the foundry losing money directly, but other operations might be delayed, and the works might not be able to complete the work within the contract time.

He agreed with Mr. Bartram that the quantity and grain size of coal dust used must depend upon the nature of the castings produced. Commenting upon Mr. Nunn's remarks, he said that a fine sand, such as Erith sand, needed only light milling.

On the motion of the Branch-President, a hearty vote of thanks was accorded Mr. Francis for his Paper.

(*Concluded on page* 306.)

* See F.T.J., vol. 40, pp. 493 *et seq.*

Some Scientific Principles of Casting Metals.*

By H. C. Dews.

It is intended in this Paper to review some of the scientific considerations which govern the production of perfect castings. There are a number of general principles which underlie the casting of all metals and alloys, and although certain of these principles may appear more important with some metals than with others, it is necessary in order to put foundry work on a scientific basis to consider all relevant factors before due balance can be maintained between those of outstanding and those of minor importance. A broad outlook is necessary and a readier transposition of conclusions obtained in one type of foundry to the problems of others. Much disservice in this connection has been done in the past to foundry science by too severe particularisation, especially in regard to ferrous and non-ferrous alloys. This Paper has, therefore, been written from the viewpoint of castings in general.

At the present time engineering science is progressing faster than the improvements in materials, and in many branches development is restricted by the apparent limitations of the available metals. For example, steam plant is being used at higher pressures and superheat temperatures, and each advance limits the choice of suitable materials to a smaller range. Engines, too, of all descriptions, are being driven at higher speeds, and power is being developed and transmitted to more slender units. Higher stresses are thus imposed on working parts collateral with a reduction in their weight and size. The development of new materials is obviously a necessity to progress, but as there appears to be already a large number of first-class materials available for common use, it is necessary also to ensure that the best use is always made of available alloys. Much dissatisfaction could certainly be avoided if constant reliability could be assured from common alloys. Nobody can reasonably seek to hinder research which endeavours to discover new materials, but, at the same time, there must be equal encouragement to pursue research which seeks to improve our common materials. The latter work is often less spectacular than the former, but it is equally useful. This applies particularly to the production of castings.

It has been difficult in the past to persuade scientific investigators to undertake the seemingly tedious work necessary to place foundry production on such a sound basis that the best value possible becomes easily and readily attainable in all castings. Efforts in this direction have generally been left to the practical man whose only impetus in place of a scientific training has been his traditional British passion for reliability. Rule-of-thumb methods and tests have been adopted, with the result that accumulated tradition frequently hampers attempts to achieve an orderly survey of foundry details. Happily there are signs that this state of affairs is now passing, and the time is approaching when one may expect to see regularly discussed the basic principles governing all casting operations.

It is not difficult to understand the definition of a perfectly sound casting nor to determine how far any given casting falls short of perfection. At atmospheric temperature and pressure a unit mass of any alloy should occupy a certain volume. Its specific gravity should be a definite value. If several pieces of the same metal in the cast condition are submitted to density determinations, it will generally be found that different values are obtained for each piece of the casting, and that all the figures are lower than the true maximum density. The differences are due to the presence of cavities in the body of the samples. These cavities may be filled with foreign material or gases or may be almost vacua.

A scientific study of founding must begin, therefore, with a class analysis of the cause of the discontinuities which reduce the density of castings. Afterwards means must be found for their elimination. First in importance amongst the causes of porosity in castings is the effect of volume changes induced by casting, and, in particular, that volume change which occurs during the passage of the metal from the liquid to the solid.

When any mass of liquid cools until it has solidified the temperature fall may be divided into three definite stages; there is the period when the mass is entirely liquid, the period when solidification is proceeding, and finally the period when the solid mass is further cooling. During these three periods three distinct volume changes are proceeding.

The effect of cooling substances in the liquid state, whether molten metals or otherwise, is to decrease their volume, and this shrinkage usually proceeds fairly regularly until the solidification point is reached. There is a deplorable lack of data with regard to the shrinkage of liquid metals. Some attempts have been made to measure the liquid contraction of a few pure metals and low melting-point alloys, but figures for the large range of industrial alloys with fairly high melting points are almost entirely lacking. The experimental difficulties in such determinations are very great, but that they are not insurmountable has been lately ably demonstrated by D. W. Berlin,[1] who has determined the densities of a range of steels at several temperatures in the liquid state.

After a mass of metal has completely solidified any further fall in temperature produces a gradual diminution in volume. Few metals contract by the same proportion over all ranges of temperature. In most cases the contraction becomes less as the temperature falls. There is a wealth of data available on volume changes in the solid which is commonly expressed as coefficients of linear or cubical expansion, but from the foundryman's point of view most of these data are unsatisfactory, as they do not include temperatures near the freezing point, and it is only near the freezing point that solid contraction plays any part in the production of dense castings.

There now remains to consider the cooling period when the mass of metal is passing from the liquid to the solid state. All materials which crystallise on freezing undergo at this time a sudden change in volume. Some materials expand, others contract. The expansion of water on freezing is well known. Amongst metals and alloys there are very few which expand on freezing. Bismuth and some of its alloys are the best-known examples. The majority of metals contract on freezing, and the extent of the contraction varies from 1 per cent. to about 7 per cent. in most cases. The production of dense castings depends more on the control of the volume change on freezing than on either of the contractions occurring in the other two periods just considered, but it is remarkable that of the three values those for the contraction on freezing are least exactly known. Foundrymen for generations have been acutely aware of the large volume change which occurs during the freezing of their castings and have built up an elaborate technique to overcome the failures which it is liable to account for. In only a few cases, however, has a real scientific investigation of the matter been undertaken, and until recently very few of the investigators have had a proper conception of the exact value they were seeking. The author[2] recently published a review of most of these published researches, and it was shown that the chief fault of many early investigations was the failure to isolate the volume change on freezing from the volume changes occurring in the liquid and in the solid states. There are one or two exceptions to this criticism, such as the work of Endo[3] in Japan and of Goodrich[4] in England. These researches merit very careful attention, and a selection is given in Table I of some of the figures.

Table I.—*Volume Changes on Freezing.*

	Per cent.
Bismuth	3.47 to 3.32*
Antimony	1.40
Tin	2.97 to 2.80
Brass (60/40)	2.89
Lead	3.85 to 3.44
Silumin	3.47
Copper	4.05
Aluminium bronze	4.27
Duralumin	5.06
Aluminium	6.26
Zinc	6.50

* These figures represent expansions. Figures for the remaining metals represent contractions.

From considerations of the density changes during the freezing, it may be seen that the net change in volume across a given section of the casting may vary from an expansion to a contraction, and that the extent of the contraction or expansion depends on a multitude of conditions. If the combination of conditions is such as to produce neither expansion nor contraction—an ideal well worth great efforts to achieve—the resultant casting will be perfectly to size and of a maximum density throughout. If the conditions are such that a net expansion occurs across the section, then either the walls of the casting will be pushed outwards or, if the mould is sufficiently resistant to prevent this, the last few drops of liquid metal will be squeezed into a neighbouring section and so pass back out of the mould through a runner or riser. Finally, a net contraction may occur across the section. This is by far the most frequent result in foundry practice, and upon the success of the methods adopted to deal with this contraction depends the ultimate density of the casting.

When a section of a casting contracts during freezing, the thickening outer shell of solid metal may be pulled inwards to fill up the space left in the centre by the contraction. Unless the section is fairly thick and if the net contraction is not too high, a perfectly dense casting may be produced through this occurring. With a thick casting, however, or when the contraction is high, the movement inwards of the casting wall to fill up the whole of the shrinkage cavity can only occur when the casting is very favourable in shape. The type of mould, too, is not without influence, since a strong mould, with a rough surface to which the first solid wall of metal may be keyed or to which it may be united by a cement of slagged mould material, will prevent the solid metal from sinking inwards. In most cases the solid metal must be ductile near its freezing point if the contraction is to be made good by drawing inwards of the solid walls without them being cracked. A large localised contraction may cause such inward movement of the casting skin as to cause a depression which may be sufficiently serious to cause rejection of the casting.

When the contraction is high, although some shrinkage of the walls of the casting may occur, cavities will still be left in the interior of the cross-section at the end of freezing. These cavities can only be filled by the flow of liquid metal from a neighbouring cross-section. So far only a single cross-section of the casting has been studied, but now this cross-section must be considered in relation to the whole casting. It can be seen that if liquid metal is required

* Exchange Paper presented on behalf of the Institute of British Foundrymen to the French Foundry Technical Association at its Ninth Foundry Congress, held in Paris on October 24 and 25. The Paper has been slightly abridged.

to fill up the cavities left by each freezing cross-section, that the casting must solidify in a previously-arranged sequence. As each casting is a law unto itself, this subject cannot be discussed further in general terms, beyond pointing out the importance of progressive freezing from remote portions to feeding points.

Assuming the order of freezing of various parts of the casting has been properly arranged, it will be necessary for the metal to flow towards the solid-liquid interface. The freedom with which such movement can occur depends on a variety of complicated conditions. Among these conditions must be considered the fluidity of the metal, the presence of solid inclusions, the effect of gases, the crystallising habit of the metal, its microstructural features and so on.

Every practical foundryman is aware of the differing capacities of different alloys for properly filling his moulds and of the effect of casting temperature on this property. Some alloys are so sluggish that difficulty is found in producing castings true to shape and with sharp edges. Other alloys are so very limpid that they not only truly fill all the corners of the mould but they also penetrate into the pores of the sand. Most alloys are more sluggish near their freezing points, and as the temperature is increased they become more fluid. The fluidity of an alloy affects its capacity for feeding, since a highly-viscous metal will not so readily flow into contraction cavities as one which is more fluid.

A quantity of empirical data and practical experience is available with regard to the fluidity of the common metals and alloys, but really accurate scientific data are deplorably lacking. The experimental difficulties in carrying out the necessary determinations at high temperatures are considerable, so that the available data mostly refer to low melting-point alloys and metals.

Many fluidity experiments of a less fundamental nature have been made by pouring metal into a long mould and noting the length of the subsequent casting. This method was originated apparently by T. D. West in 1898 and has been followed by several workers since. In 1919 Saits and Hayashi[5] adopted a spiral mould made of fine dried sand and run under standardised conditions. The spiral-mould method was further improved by Remy, Ronceray and Curry in France. In spite of the many refinements the method suffers from grave fundamental objections from the point of view of the effect of fluidity on the flow of metal in a freezing casting. Some of the disadvantages of the spiral-mould experiments have been recently discussed by Luigi Losana,[6] whose work is of exceptional interest. Losana has used a special type of capillary efflux viscosimeter for temperatures below 400 deg. C. and a rotating-bob viscosimeter for higher temperatures, and he has determined the relative fluidity of a very large number of common metals and alloys. This is the first research to throw any considerable light on the real fluidity of a range of metals, and there is little doubt that an extension of the same principle to study the effect on fluidity of various additions to common alloys would lead to interesting results in foundry practice.

Inclusions such as oxides, slags or mould materials are often found in castings. Such inclusions often prevent the liquid metal from flowing into contraction cavities. Most metals in the foundry are covered with a layer of slag or oxide when resting in the ladle, and unless the surface dross is held back during pouring the casting will be imperfect. Many inclusions also originate during pouring in another way. The liquid stream may oxidise on its outer surface and this oxide skin may be then carried into the casting. With alloys containing zinc, aluminium and silicon particularly oxide skins are formed which are not wetted by the liquid metal, and the oxides then appear in the casting more or less balled up or in stringy films. Choke runners often keep back oxides formed during pouring, and undoubted advantage results from a more general use of this type of runner. Finally, oxide skins may form as the metal flows about the mould cavity, and to minimise this danger it should be arranged that the metal fills the mould without undue turbulence and with the smallest possible surface exposed. In the case of castings with extensive flat surfaces or containing cores with flat under-surfaces, tilting the mould usually leads to less surface exposure. In other cases it can often be arranged that oxide skins are carried out of a conveniently-placed riser. Pieces of sand and mould dressing washed off the mould also hinder feeding, and adequate precautions should be adopted to prevent this happening.

The effect of gases on metals has been the subject of a good deal of research, but still causes foundrymen much trouble. The nature and origin of gases in metals are many and diverse. The mould itself may supply a large volume of gas in the form of steam from green sand, air held in the pores of all sands, carbonic oxides from the ignition of carbonaceous mould facings and materials, such as sawdust incorporated with core sand, hydrocarbons from the decomposition of organic bond, such as linseed oil or organic dressing on chills, gases occluded by chills and so on. It has been calculated[7] in a very simple case that the mould gases may generate a pressure of 10 atmospheres at the metal face, and in complex cases the presence of gas may quite reasonably be much higher. Under such pressures mould gases may find their way into the liquid metal. Some may be dissolved or combine with the metal, but more generally such gases remain insoluble as distinct bubbles. If the casting is sufficiently liquid and the quantity of mould gas is small or liberated only during the first instance of filling the mould, the gas will usually rise through the casting and escape from a riser or runner. If the mould gases are large in amount and liberated late in the casting process, the metal may be too viscous to allow the bubbles to escape, and they then appear in the solid casting as blowholes, frequently irregularly distributed and confined to the surface of the casting. There is also the possibility of atmospheric air being entrained by the liquid during pouring. In many cases the liquid will be sufficiently fluid to allow such entrained air to escape again before the casting begins to solidify, but in other cases entrained air may be found in fairly large bubbles on the top portion of the casting, in isolated angles or under cores. Holes in solid castings, originating in turbulence or injection of air, are thus by their location usually easy to identify.

There is another class of gas troubles which are caused by gas originating in the metal itself. Most metals dissolve or combine with certain gases, and these gases may be present in the raw metal as purchased or may be picked up during melting. It is usually found that dissolved gases are less soluble in the solid than in the liquid metal and are less soluble as the liquid temperature falls. Consequently, as the casting cools gas is liberated. In some cases when gases are liberated at temperatures well above the freezing point they have opportunity to escape through the liquid metal, although, if the volume of liberated gas is large and the liquid metal is fairly viscous, such gases become trapped and appear in the final casting as distinct bubbles. The extent of the liberation of such gases may also depend on the rate of cooling of the metal. The effect is similar to that from the mould gases just discussed, except that these metal-gas bubbles are usually small and distributed generally throughout the casting; it is sometimes difficult to distinguish them from mould-gas bubbles. The ultimate effect of blowholes on the casting is purely mechanical, as they affect feeding only very slightly and according to the degree in which the liberated gas causes turbulence in the metal.

A much more complicated case arises when gases are liberated from the metal actually during its solidification. Most of the controversy on gas questions centres round this type of reaction. Many castings show discontinuities, which follow the contours of the crystallites of the metal. If it is assumed that gas was liberated from the metal during solification, in such a case it may be reasonably said that it would conglomerate around the growing dendrites until a gas envelope was formed at the solid-liquid interface thick enough to interrupt continuous crystallisation. Evidence that this happens is very difficult to accumulate, and it is invariably found on carefully studying the work of those who have tried to ascribe dendrital cavities to the buffer action of gas envelopes formed during freezing, that the argument rests almost entirely upon speculation. If it is assumed with respect to such a cavity that no gas was liberated during freezing, it is equally reasonable to believe that the contraction of the metal would itself leave cavities around the edges of the dendrites in exactly the same way. Indeed, it is frequently possible to find such a dendritic contour in the open tops of ingots and risers where, obviously, contraction can be the only isolating medium. There is also a middle course to adopt in this controversy. It may be assumed that the dendritic cavities originate in contraction which may be filled with and possibly propagated by gas accumulations. In the face of the acute controversy which ranges round the cause of these cavities—particularly in cast iron—and in the face of the superficial reasonableness of the various lines of argument, without sound experimental proof, it is unwise to be dogmatic on the point.

Many foundrymen favour the theory that the interdendritic cavities are due to gas buffers, and some—particularly Continental foundrymen—say that the source of the gas is atmospheric entrainment. The latter refinement has received little support in England. The author has frequently found that iron castings, to which the entrained-air theory has been chiefly applied, when made with a pencil runner through which it would be very difficult for air to be carried into the casting, show exactly the type of dendritic cavity described as due to entrained air. It is equally easy to show that these cavities are not due to mould gases, as they may make their appearance in castings from moulds made in ganister and similar materials which do not produce gases. Furthermore, these cavities are invariably well inside the casting, and it is difficult to see how mould or atmospheric gas could fail to leave its effect on the outside skin of the casting. In view, therefore, of our present experience, it seems most reasonable to suggest that if these interdendritic cavities are in any way connected with gases at all it can only be with the gases liberated from the metal itself during solidification, and even this remains to be proved.

There is now to be considered in relation to feeding the crystallising habit of the metal or alloy, and on account of its influence on crystallisation the range of temperature through which the alloy crystallises. A close study of these factors would help to classify alloys according to their desirability from a foundry point of view, and would prevent some of the waste labour now frequently expended in exploiting alloys which eventually prove extremely difficult to cast. Occasional speculation on this subject can be found in metallurgical literature, but usually the theories are founded on a too narrow range of materials. So far, few theories meeting general approval have emerged.

Some metals show a marked tendency to an accicular form of crystallisation. A common example is antimony, the pine-tree appearance of which will be familiar to most foundrymen. Other metals, such as copper, tend to crystallise with an equiaxed structure, showing the familiar polygonal grains. It is notable, too, that alloys

(*Concluded on page* 308.)

Foundry Activities in Sheffield.

CLOSED OR OPEN PROFESSIONAL INSTITUTES?

At the opening meeting of the Sheffield Section of the Institute of British Foundrymen the Hon. J. M. W. North, the newly-elected President of the Sheffield Branch, in his Presidential Address outlined some advantages accruing from keeping the ranks of the Institute as wide as possible. On being called to the chair, Mr. North, in the course of his address, said:—

Mr. Oxley and Gentlemen,—I feel I owe you all an apology, and this I wish to make on account of my absence last year when you did me the honour of electing me President of this Branch for this session. However, I will try to make amends for it now, and first of all I must thank you for placing me in this favoured position today.

In spite of my absence during the early part of this year the committee have done their utmost, and I must here particularly mention the secretary, Mr. Walker, to make all arrangements so that this session should be the best yet held. With your support I hope we shall succeed, because it is your support, your enthusiasm and your goodwill that is capable of making this Branch the most flourishing in the country and by so doing forwarding the interest of the Institute as a whole.

Progress of the Sheffield Branch.

The total membership of the Section has dropped from 206 in 1923 to 160 in 1930, a fall having occurred in every year except 1927, when the Conference was held in Sheffield. Analysing this loss of membership, we find it is chiefly due to a loss of Associate Members, who account for 32, against a loss of 9 full members and 5 Associates. But whilst local membership has fallen, the total membership of the Institute has risen every year, with the solitary exception of 1925, from 1,525 to 1,798. Moreover, the membership of our Branch has decreased by 46, and the Institute as a whole has increased its membership by 273.

Some causes which have contributed to the fall in our membership in these recent years are death, retirement, change of occupation, removals to other districts, and lapses due to non-payment of subscriptions on account either of inability to pay or lack of interest. Some of these are connected with the present state of trade and the closing of foundries, due to rationalisation.

The present conditions of trade are universal, but, as the total membership of the Institute has increased, it shows that this Branch has not done so well as some other branches. I think it is up to us to remedy this, and it can only be done by attracting new members, by making our proceedings and activities more necessary for their well-being, and by our present members using every endeavour to encourage the younger men to join. How is this to be accomplished?

There is at present a movement on foot for making the passing of a qualifying examination necessary for membership of the Institute. Now we will pass over for the moment the needs of this Branch to bring our membership to a steadily-increasing figure and consider movements on foot for improving the status of the Institute as a whole and see how it affects us.

The Status of the Institute.

Does the Institute want members from the point of view of their own advancement, in knowledge gained from lectures and discussions, or does the Institute want to entice them with social entertainments, such as smoking concerts, dinners and amusements, in order that they may attend lectures and thereby exchange and discuss foundry problems? It has already been arranged to award diplomas for voluntary examinations, which is a very beneficent idea.

In awarding these diplomas for examinations upon practical or technical matters, or for presentation of meritorious Papers, the Institute is benefiting members to the extent of their being able to obtain credit for a certain standard of knowledge and competency in foundry practice. Members who wish to gain these diplomas can do so provided they have the necessary ability; those who do not wish to, need not do so. By closing the ranks of the Institute and having membership by examination only, of alternatively a practical or theoretical nature, people would presumably want to enter the Institute on account of the benefit received by having a professional status, shown by letters after their name, which at present everyone is entitled to by merely paying a subscription.

This means, of course, that it will take a generation to accomplish, as all present members will be admitted without examination, but all new members will have to enter under the new status; also, there is always the question of the practical use of examinations, for knowledge alone is useless without having the ability to apply that knowledge. At the same time, the ability to apply without the knowledge is worse. It seems to be not so much a matter of what the present members require as a matter concerning the future welfare of the Institute as a whole, having regard to the period of time required to accomplish this suggested radical change, bearing in mind the fact that a lengthy period must nearly always elapse before the full benefit of any change such as that under consideration is felt. However, the Institute should be conducted so that the maximum benefit may be obtained by the majority of its members, and as we do not know the accomplishments of these future members of the Institute, it is perhaps only right to assume that the present members should be the best judges as to the requirements of future members.

We have a committee representing the members of this Branch, but it is not always easy to get the expressed opinion of this committee, and, if we do, it does not always represent the true opinions of the majority of the members, and we are, therefore, arranging another smoking concert in order that we may all have an opportunity of expressing our views, requirements and grievances. I hope among these there will be at least some constructive criticism. The future, therefore, of the Institute, and of this Branch in particular, depends on the requirements of the present members according to their number and calling.

It has always been, I gather, the object of this Institute to welcome all comers, whatever their position in the foundry world. This object is worth a very great deal, and means that it is possible for the manager, foreman, chemist, moulder, patternmaker, or anyone, whatever their position, interested in foundry work, to get together, discuss their difficulties and express their opinions. The social side of the Institute tends to create good fellowship and an easier exchange of opinions, and that is why in my opinion this is not only worth retaining, but developing.

In closing the ranks of the Institute and admitting members only on examination it might be difficult to maintain the present wide range of its membership. It can be argued that either the total membership would be increased on account of members receiving greater benefit by the elevated status, or decreased owing to the difficulties of examination, both a matter of opinion.

It remains to choose between the freemasonry of the Institute as it exists now, at the same time endeavouring to make it more attractive for members, more instructive and edifying with the advantages gained from the awards for voluntary successful examination, and the increased status accruing from the closing of the ranks and the use of letters after one's name which would have a certain potential value as showing a certain standard of knowledge attained.

This does not affect at the moment any of our own immediate difficulties, and although it is naturally of considerable interest to us, we have in the meantime got to get together, help ourselves, and consolidate the position of this Branch.

The committee have arranged during this session another smoking concert, on October 24, in order to discuss and talk about the Institute as a whole and the particular requirements of this Branch, in the hope of finding suggestions so that members may take more personal interest, and also to give some slight entertainment by way of compensation.

Sessional Activities.

Other attractive features of the programme for this session include cinematograph films exhibiting the latest foundry practice, a special lecture by Dr. Pullin on X-ray examination of castings, which is practically a certain development in foundry practice, and other interesting lectures and discussions.

Lectures and discussions in the past have been good and occasionally very good, and there is no doubt that a real heated discussion is always interesting, generally conducive to the extraction of valuable knowledge, and certainly attractive to new members; however, very often discussions have failed in this respect, and I always feel that there are people like myself who would like to make remarks or ask questions, but cannot, on account of that peculiar phenomenon of human nature, which allows one man to speak all day, and another not even to utter a single remark, and yet very often the outside world would prefer to listen to the thoughts, put into words, of the silent one than those of the voluble one.

Now I hope we shall find a means of overcoming this apparent difficulty by making our meetings as informal as possible, and thereby getting a round-table discussion. Perhaps I labour under a slight delusion, but if so, that is one of the many things that could be put right at our next smoking concert, and I hope we may hear of further suggestions or comments that have not occurred to me.

Pessimism.

As regards the foundry industry as a whole, Mr. Oxley, in his address last year, enumerated the advances that have lately been made, and I will not now reiterate his remarks but merely formulate a plea for the further advancement in science, organisation and foundry practice which our meetings ought materially to assist by the exchange of views which should take place. We all realise that the state of trade in this country at the present time is far from what we desire, but it seems to be the practice of most people to make out that this state is even worse than what it appears. One notices up and down the country a frightful pessimism which is of little use and ought to be overcome. We do not gain any credit from flaunting our diseases in the face of the world. This pessimism surely shows a lack of enthusiasm and enterprise which is so essential to the well-being of the country. There are certainly exceptions to this state of affairs, and in certain trades, where it is known they are experiencing difficult times, a happier spirit and outlook exists from which they are certainly benefiting.

Local Rationalisation.

There have been in Sheffield and elsewhere lately schemes of rationalisation taking place, which must soon prove their merit one way or

another. Rationalisation means reorganisation, and it is successful organisation in every phase of business that is generally the keynote of success. Organisation in the foundry trade has lacked some of its essential properties until recent years, and it is only with the advent of mechanisation and the application of science to the industry that progress has been made in this direction. Co-operation among these various forces has now become imperative, and must replace the prejudice and conservatism of foundrymen, so often met with in the past, and which arose from the lack of knowledge, of outside engineers and designers, of foundry practice. The result of this was that collective processes of foundry work were treated as the operation for one man, when each process should form the subject of specialisation.

Specialisation, in my opinion, in every branch of the trade is now essential, and the only successful medium of this specialisation is by first-class organisation, which will give us our ultimate aim, namely, progressive co-operation. There must always be competition, and to obtain our fair share of the world's markets we must produce and sell as cheaply as other countries, for, competitively, we are always in a favourable position, as, prices being equal, preference is often given to British products on account of their superior quality.

Wages should be as high and hours as short as a country can economically afford, and the cheapness of production must be obtained from a maximum output by up-to-date methods. The more machinery installed to save labour the more it is essential that that machinery be kept usefully employed for a 100 per cent. of its time. The more labour saved the more that labour must be directed to further useful work, and there must be a spirit of determination to earn more wages for more productive work—and facilities given to do so.

Where old machinery is in operation that also must be kept fully employed by obtaining suitable work, or, if this is impossible, the machines must be removed. One often notices in going round certain fairly modern foundries that this is not the case, and in ascertaining the cause, one wonders whether there has been in the erection of these plants *that co-operation* between the foundrymen and the engineer responsible for the plants, that is so essential for their ultimate successful operation.

With regard to science as applied to the foundry industry, this Institute does everything possible to further this object in each of its different phases. It is with your help and enthusiasm, gentlemen, that we hope to improve this Branch, not only to benefit ourselves but to raise its position in the Institute as a whole, and we trust and believe that while this is being accomplished a similar improvement will be taking place in the trade of this district, brought about by a happier spirit of co-operation and enterprise.

New Companies.

Ladyacre Engineering Company, Limited, 11, Ladyacre Road, Lanark.—Capital £5,500 in £1 shares (1,000 5½ per cent. preference). Directors: R. Black and R. M. Wilson.

Galway Foundry & Engineering Company, Limited.—Capital £7,500. Directors: M. McDonogh, Flood Street, Galway; T. McDonogh, J. F. Costello and M. J. MacDonell.

Humphreys-Dywidag, Limited.—Capital £2,000. Contractors, engineers, etc. Directors: G. Freeman, 187, Knightsbridge, London, S.W.; R. A. Quigly, Dr. G. Wolff and Hans Kreisselmeier.

Marshall & Company (Stretford), Limited, 446, Stretford Road, Old Trafford, Manchester.—Capital £500. Iron, brass and other metal founders, etc. Directors: A. V. Shaw and H. Marshall.

Collecting and Assembling Technical Information.

At the opening meeting of the London Local Section of the Institute of Metals the chairman, Mr. W. T. Griffiths, M.Sc., delivered an address on "A Present-Day Problem"—that of keeping up to date in matters appertaining to one's profession. Of the immense amount of new and varied information which is being made available every day, only a small percentage is of direct interest or use to the individual. Mr. Griffiths suggested some means whereby one could partially solve the problem of sifting out and assembling this desired information.

Primarily, he advised the regular attendance of meetings held by the local section of the Institute of Metals. The same subject was rarely discussed twice, and the Committee would welcome suggestions from members whereby the value of the meetings would be enhanced. Participation in the discussions was of great benefit to all, for not only did they encourage the expression of thoughts in words, but also they very often revealed the results of others' practical experiences. A larger attendance of the meetings was to be encouraged, as a wider field of interests and a greater range of experience would then be introduced. The presence of engineers, draughtsmen and others was of help, in that the less technical metallurgical questions could be approached from several different points of view, of which the purely metallurgical-minded were sometimes inclined to lose sight. The associate membership of the Institute was suited to those people to whom reference has just been made, and to the younger colleagues who could not yet apply for full membership.

For those definitely engaged in the profession of non-ferrous metallurgy, membership of the Institute of Metals was one of the best ways of keeping up to date. Much new knowledge is first disclosed at its meetings; members are supplied with preprints of Papers and with a bi-yearly journal, containing the Papers and discussions on them. The spring meetings are always held in London. The autumn meetings are held in the provinces or abroad, where members are able to visit the metallurgical and engineering plants of other countries. At the headquarters, in Victoria Street, the secretary, Mr. Shaw Scott, and his staff are always willing to help members to secure up-to-date information, and in addition there is a library where the more prominent of the world's technical journals may be consulted. A fine selection of books which members may borrow also is available.

The British Non-Ferrous Metals Research Association, the function of which is to provide means of co-operative research for the benefit of its members, also has its headquarters located in London. A development staff assists members to apply research results to practice; an information bureau and library makes available information on non-ferrous subjects from world-wide sources; and its publications contain not only the results of its own researches but reviews of foreign practice and translations.

Mr. Griffiths next dealt with the great mass of technical literature which is being continually published. He suggested the selection of a few periodicals dealing with the particular aspect of metallurgy in which the individual is interested. Of the 30,000 or more technical periodicals which are published, the total of purely metallurgical journals is quite small. There is an inclination to consider that the reading of these is of little importance and should be done in one's spare hours instead of reserving time regularly for the task. The speaker enumerated the principal English, French, German and American periodicals from which he found he gained most information. This list included The Foundry Trade Journal.

Abstracts are of considerable value in that they allow one to review a large proportion of the information concerning metallurgy and related subjects which appears in the technical Press. No one, however, should rely on abstracts for securing information of vital interest. They should serve only as guides for either studying closely or passing over the originals. The problem immediately arises as to where originals may be consulted. In London this is very much simplified. Apart from the libraries of the Institute of Metals and of the B.N.F.M.R.A., one of the most useful and convenient is the Patent Office in Chancery Lane, where 3,000 periodicals and 220,000 volumes are available.

The Science Library attached to the Science Museum has 8,000 periodicals dealing with every section of science. Admission is by ticket, obtainable from the Director of the Museum, and members of approved institutions may enjoy the privilege of being able to borrow books. The British Museum possesses the largest library in London, but access is not so convenient. The National Central Library acts as a "reservoir library" to nearly all the municipal and county libraries, and as a clearing house for the loan of books from "outlier" libraries. It issues books only through the local library, to avoid duplication; students apply to the local librarian, who in turn requests the librarian of the National Central Library to make the necessary arrangements for supplying the required book.

The translation of originals requires a person who not only knows the foreign language, but who also has metallurgical knowledge. A panel of translators has been formed by the Association of Special Libraries and Information Bureaux (Aslib), whereby members can be introduced to suitable translators. Non-members can make use of this service on payment of a fee.

After one has obtained information the final problem is to record it. It is impossible to keep copies of every printed detail; all that one needs is an indication where one can find the printed data. Mr. Griffiths suggested that the best way of doing this was by some indexing system, of which the card index is the simplest. One of the well-known and well-tried systems should be chosen and departed from only for a special reason; any modifications to the system should be made into rules to avoid complications. For the small specialised index a properly-conducted alphabetical index, governed by a carefully selected group of rules, has much in its favour.

Sand Practice in Southern Foundries.

(*Concluded from page* 302.)

A Tribute to the late Mr. Ellis.

Before the presentation of the Papers the sad news was conveyed to the meeting by the Branch-President that Mr. James Ellis, one of the founders of the Institute and one of its first Presidents, had passed away. The Branch-President recalled that Mr. Ellis had also been an active member of the London Branch for many years, and had introduced him to the Institute. In the loss of Mr. Ellis he had lost a personal friend, for whom he had a very great regard. Mr. Ellis had been one of the old school, and had always held before him the ideal which was embodied in the Institute's motto—"Science hand in hand with labour." He had been anxious always to help the younger members particularly, and was always glad to do anything for the Junior Branch or for any of the young members of the Institute. The members of the London Branch and of the Institute as a whole had lost a valued colleague.

At the Branch-President's suggestion, the meeting stood in silence as a mark of their respect for Mr. Ellis.

Mr. Frank Shaw, carrying on business at Ghyllroyd Foundry, Guiseley, ironfounder, has been adjudicated bankrupt.

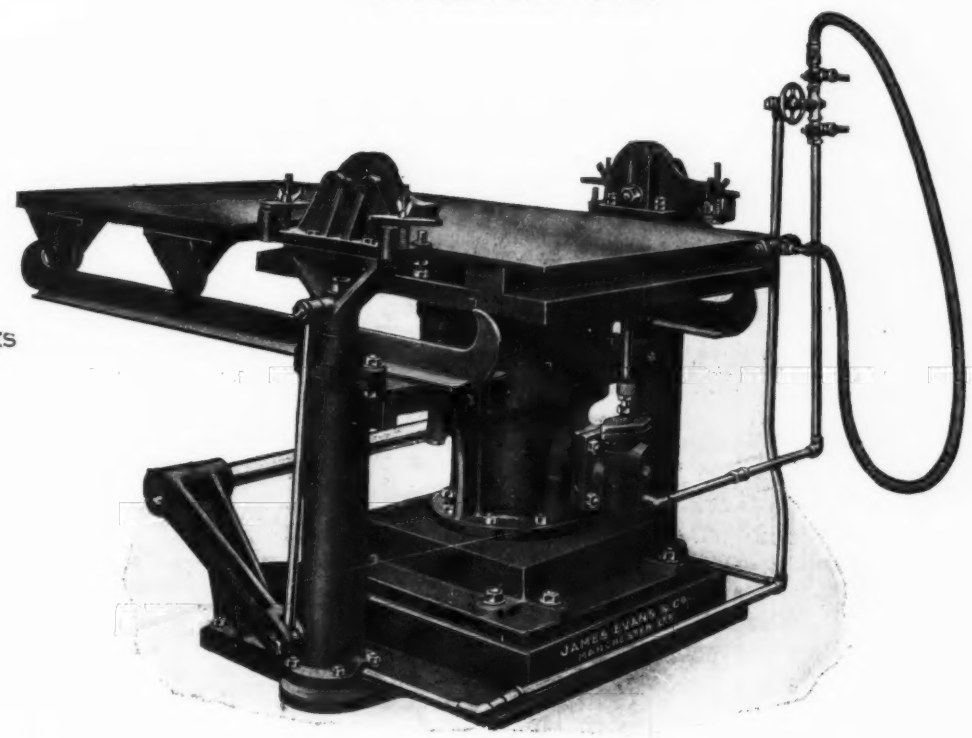
TYPE "C"

JAR RAM MOULDING MACHINE

with Turnover Pattern Plate.

For Pneumatic Power.

TWO MACHINES IN ONE.



UNSKILLED LABOUR ONLY REQUIRED.

The above machine illustrates a Jar Ram Machine with Turnover Pattern Plate which can also be used for Stripping Plate Work.

The machine has been designed to combine the two distinct features above mentioned, and is practically two machines in one, equally suitable for steel, iron, etc.

The machine as illustrated is arranged for work that requires turning over, such as steel moulding. And while the turnover arrangements are intended for general repetition work, by detaching the turnover plate from the trunnion brackets the machine can be used for stripping plate work by attaching the stripping plate to the trunnion brackets. Or, on the other hand, by removing the trunnion brackets as well, the table can be used for jolting general jobbing work.

A very important feature of the machine is the simplicity with which the intensity of the Jolt can be regulated when the operator has become accustomed to the use of the machine, which takes but an hour or so. The valves all being on the exterior of the machine are easily accessible, and there is an adjustable arrangement that will allow the jolt to be varied between 1½ in. to below ¼ in. This being done without disturbing any part of the machine.

The machine is supplied with Withdrawal Carriage, Vibrator, and Blow-off Nozzle complete. It is substantially constructed to stand heavy wear and tear, and requires a minimum amount of skill to operate.

Another important feature of the machine is in the arrangement of the hard wood anvil block for receiving the shock. The blocks being carried well down the machine in a specially designed annular chamber give considerable relief to the foundations. It also provides against the possibility of fracturing the jolting table. Pitch pine blocks are also inserted between the foundation plate and the machine bedplate to assist in the relief on the foundations, and these features considerably improve the working advantages of the machine.

IT IS ALSO ENTIRELY OF BRITISH DESIGN AND MANUFACTURE.

JAMES EVANS & CO. (M/c) LTD.

Britannia Works, BLACKFRIARS, MANCHESTER.

The Standardisation of Cast-Iron Gutters.

By "Vallishe."

In the following article the writer proposes to deal with cast-iron roof gutters of the heavier section. The "plumber's gutter" will not be considered, as this type is already to some extent standardised. Numerous foundry products are to-day pretty well standardised, but the greater percentage of castings are, in their respective classes, turned out without any attempt at standardisation. Heavy- and medium-section roof gutters provide a striking example of the latter case. One cannot altogether blame the foundries, for if a customer demands a certain type of casting and is prepared to meet the cost, one cannot afford to ignore his requirements. Illustrative of the unnecessary number of different sections of gutters in use to-day, the writer recalls the following example:—An inquiry was received for four ranges of cast-iron gutters, each range being approximately 75 ft. long. None of the ranges had to connect up to any existing gutters, yet three different sections were specified.

Without doubt some of our smaller architects are partly to blame for such conditions. They design a gutter to suit their particular requirements, and, consequently, very often find that no foundry has a stock pattern of the desired section. A new pattern, and, perhaps, new moulding boxes, have to be made, and the customer must foot the bill. Surely founders can do something to remedy this undesirable state of affairs.

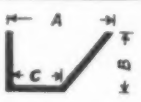
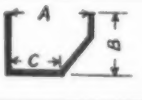
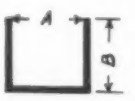
In Table I the writer outlines an idea which, although not fully developed, serves to show the general proposal. A list is detailed of the various gutter patterns stocked, and the size, section, weight, type of joint, etc., and reference letter (for ordering) are given. The list is then circularised to all the foundry's customers, architects, consulting engineers, etc. A leaflet may also be enclosed, embodying various other particulars and enumerating the advantages of keeping to these sections of gutters wherever possible.

Such a procedure could not, of course, in itself, bring about a complete standardisation throughout the trade. Some foundries possess gutter patterns and boxes of totally different sections from others. Nevertheless, if each foundry specialising in roof gutters would issue a list, the industry would be making great strides in the right direction. Already an approach has been made towards a standard section in the gutters used for the North light roof, 12 in. by 8 in., 12 in. by 7 in. and 12 in. by 6 in. are the general sections used.

Until founders begin to approach a definite standard, they will not secure remunerative prices; such a standard can hardly be attained without setting up some sort of a commission. Cast-iron pipes are now firmly standardised—why not gutters?

[This work is one which comes within the scope of the B.E.S.A.—Editor.]

Table I.—*Suggested Detailed List of various Gutter Patterns in Stock.*

Reference Letter	Section	Approx. Sizes A	B	C	Weight per Foot	Type of Joint	Made in Lengths	Remarks
W		14"	9"		100 lbs	Flanged Joints Caulked or Machined with Lip on Bottom	Up to 23 feet	For Heavy Roofs
V		13"	8"		90 lbs			" "
S		12"	8"		84 lbs			Commonly used for North Lights Roofs
R		12"	7"		75 lbs			
C		12"	6"		64 lbs			
M		12"	5"		44 lbs		Up to 18 feet	For Short Spans
P		12"	8"	6"	72 lbs	Flanged Caulked without Lip	Up to 22 feet	For Similar Duties as above Section
T		12"	7"	5"	64 lbs			
A		14"	6"	8"	50 lbs	Flanged or Spigot & Socket	Up to 12 feet	Mainly for Light Steel Roofs
D		12"	6"	6½"	40 lbs			
E		12"	6"	2"	35 lbs			
G		14"	7"	10"	65 lbs	Flanged Caulked or Machined No Lip	Up to 12 feet	
K		12"	6"	8"	54 lbs			
N		10"	5"	6"	42 lbs			
L		14"	11"		74 lbs	Spigot & Socket	In 10-foot Standard Lengths	Box or Catchwater Gutter
F		12"	10"		62 lbs			
J		10"	7"		49 lbs			
R		9"	4"		32 lbs			

Applications for Trade Marks.

The following list of applications to register trade marks is extracted from the "Trade Marks Journal":—

"Yorcalbro."—Metal tubes. The Yorkshire Copper Works, Limited, Pontefract Road, Stourton, Leeds.

"Aronite."—Metals. Shanks & Company, Limited, Tubal Works, Main Street, Barrhead, Renfrewshire.

Some Scientific Principles of Casting Metals.

(*Concluded from page* 304.)

containing metals with a strong tendency to dendritic or equiaxed crystallisation are themselves influenced towards that particular type of crystallisation. There are also, of course, a range of intermediate metals and alloys whose crystallisation leans one way or the other, according to the casting conditions. How far these factors influence feeding will depend on their influence on the solid-liquid interface. In the common case of a contracting metal or alloy where liquid must flow to the solid portion, a short regular solid-liquid interface is obviously desirable, and where such a condition is assumed by the natural crystallising habit of the metal, then the temperature gradient and the rate of cooling may be varied to suit other considerations. If a reticulated solid-liquid interface is likely to develop, it becomes necessary to control the temperature gradient and rate of cooling to produce the most inducement to liquid flow.

Following any discussion of the crystallising configuration, one is naturally brought to consider the constitution of the crystals and in particular the effect of constitutional changes on their shape and density. It is quite common for a polymorphic change to occur in an alloy system with appreciable change in volume, and whenever more than one structural constituent is found in a cast alloy it may be often profitable to study its presence in relation to density changes. In one case at least such a study is proving of the highest practical importance. This is in regard to the graphite precipitation in cast iron. The large feeding heads which are necessary in casting dense malleable are evidence of the high shrinkage of cast iron itself. That the grey-iron founder is not troubled by this phenomenon is due solely to the graphite precipitation occurring with increase in volume and thus filling out nearly all the shrinkage which occurs initially in both grey and white iron but which in the latter case is not corrected by any solid precipitation. Similar corrections and also effects acting in the opposite direction may be found in other alloys.

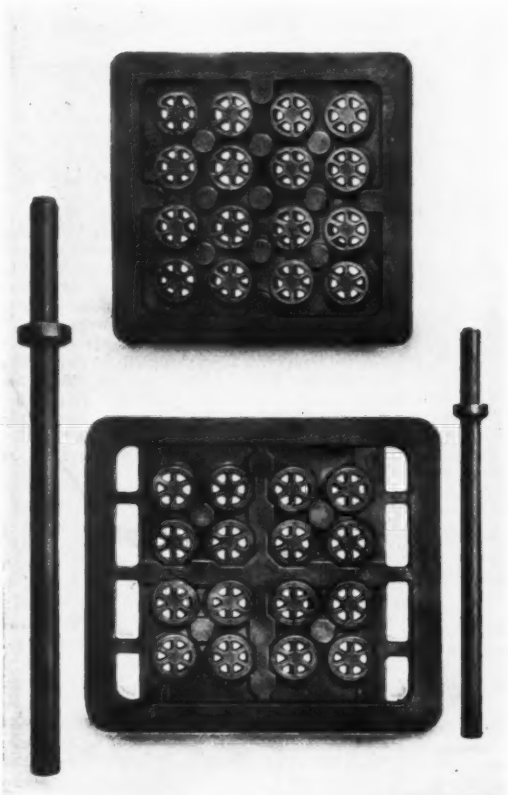
The complexity with which casting production has been presented in this Paper has been deliberately chosen to encourage discussion on the subject free from particularisation in any narrow class. Metallurgical and engineering experience has amply demonstrated that the quickest and most far-reaching advances have been achieved starting from so-called theoretical premises rather than by rule-of-thumb practice. It is hoped in this case that by linking up the experience of foundrymen working in apparently dissimilar metals a code of theory may emerge which will improve and broaden the foundrymen's work and be universally applicable.

REFERENCES.

1. D. W. Berlin, Carnegie Scholarship Memoirs, 1926.
2. H. C. Dews, Foundry Trade Journal, December, 1927.
3. H. Endo, Science Reports, Tohuku Imperial University. Vol. 13. No. 2. November, 1924.
4. W. E. Goodrich, Trans. Faraday Society, 1929, 25, 531.
5. Saits and Hayashi, Mems. College Engineering, Kyoto Imp. University, Japan, 1924, 3, 165.
6. Luigi Losana, Notiz Chim. Ind., 1927, 2, 1—4, 63—66, 121—125.
7. Skerl, Foundry Trade Journal, February 2, 1928.

Replacement of Castings by Weldings.—At a recent meeting of the Institution of Welding Engineers, Mr. P. L. Roberts read a Paper on "The Replacement of Castings by Weldings," in the course of which he said that the use of structures built up from rolled steel by welding to replace castings was first tried experimentally in this country three years ago, since when the application has extended very rapidly. Continuing, he outlined the advantages of weldings from the points of view of strength, lightness and economy, and dealt at some length with features of design.

F.T.J. 30/10/30.



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Trade Talk.

Grimsby Town Council have accepted the tender of Sir Lindsay Parkinson & Company, Limited, of London, for the construction of a new fish dock at a cost of £1,336,433.

A high-speed paddle steamer is to be built by the Fairfield Shipbuilding & Engineering Company, Limited, of Govan, Glasgow, for the Clyde services of the London & North Eastern Railway Company.

The South American Manganese Company, Limited, is being wound up voluntarily. Mr. F. H. Agar, of Messrs. Hope, Agar & Company, Pinners Hall, Austin Friars, London, E.C.2, is the liquidator.

Orders were made in the High Court of Justice on October 14 for the winding up of the Blundstone Engineering Service, Limited, Kerr Stuart & Company, Limited, and the Metal, Ore & Chemical Company, Limited.

The Newcastle-upon-Tyne Electric Supply Company, Limited, have placed an order with Messrs. A. Reyrolle & Company, Limited, of Hebburn-on-Tyne, for 66,000-volt switchgear required for the new power station at Dunston.

The annual dinner of the London Iron and Steel Exchange is to be held on December 1 at the Hotel Metropole, Northumberland Avenue, London, at 7 p.m. for 7.30 p.m. Mr. Watson Slack, chairman of the Committee, will preside.

The French company, Aciéries de Sambre-et-Meuse, reports for the financial year 1929-30 profits amounting to 4,467,927 fcs., as against 4,181,911 fcs. in the previous year. The dividend is to be 150 fcs. per share, as against 100 fcs. in the previous year.

Employees of the following firms have contributed to local charitable institutions and infirmaries: William Simons & Company, Limited, Renfrew, £284; William Beardmore & Company, Limited, Dalmuir, £1,235; and Napier & Miller, Limited, Old Kilpatrick, £113.

Four hundred men are out of employment owing to the South Crofty tin mine in Cornwall stopping operations. The Geevor Mine, St. Just, is also to close. It is stated that when this happens the only tin mine in the county to remain open will be Jantar, at Wendron.

Messrs. William Simons & Company, Limited, of Renfrew, have launched the largest dredger ever built on the Clyde. The vessel is a suction hopper dredger of 5,000 tons, and is being constructed to the order of the South African Railways and Harbours Administration.

The Cleveland Bridge & Engineering Company, Limited, have received a contract for the construction of a bridge across the River Zambesi, and some 25 miles of railway on the south bank of the river to connect the existing lines of the Trans-Zambesia Railway and the Central Africa Railway. The total contract price is £1,434,337.

Preparations are being made at the shipyard of Messrs. John Brown & Company, Limited, at Clydebank, for starting work on the building of the new Cunard liner. The berth at which she will be laid down is being lengthened, and other preparatory work is being carried out, such as the shifting of cranes and the heightening of gantries.

The joint secretaries of the Wages Board for the Scottish pig-iron trade have been informed by the accountants that they have examined the employers' books for July, August and September, 1930, and certify that the average net selling price was £3 17s. 2d. This means that there will be no alteration in the wages of the workmen.

The London & North Eastern Railway Company have allotted contracts for new crane equipment for their Middlesbrough docks. Forty-six new electrically-driven luffing cranes are to be installed, of which 37 will be built by Messrs. Cowans, Sheldon & Company, Limited, of Carlisle, and nine by Messrs. Ransomes & Rapier, Limited, of London.

Mr. E. John Wheen, who has been with Messrs. C. Tennant, Sons & Company, Limited, London, since 1912, has now started in business on his own account at 59, Eastcheap, E.C.3, to handle agencies for iron, steel or engineering firms. Mr. Wheen has been appointed London agent for Messrs. H. Lees & Sons, Limited, Parkbridge Ironworks, Ashton-under-Lyne.

The "Orari," a large twin-screw motorship, built for the New Zealand Shipping Company, Limited, has been launched by Messrs. Alexander Stephen & Sons, Limited, of Linthouse. Messrs. A. J. Inglis, Limited, of Pointhouse, have launched the motorship "Concepcion" for the Argentine Navigation Company, Limited. The vessel is fitted with two sets of six-cylinder Diesel engines.

Two important overseas orders for electrical equipment have been secured by Messrs. C. A. Parsons & Company, Limited, Newcastle-upon-Tyne. Recently the company secured the order for a 20,000-kw. generating plant for the South African railways, and last week it secured the contract for the 30,000-kw. plant for the new super-power station being built by the Municipality of Copenhagen.

The refractories department of Messrs. General Refractories, Limited, reports the receipt of an export order of value approaching £4,000. The company states that its sales during the month of September were well in advance of those for September of last year, and that its total sales for the nine months of 1930 are in excess of those for the corresponding period of its record year of 1929.

Regarding Clayton Wagons, Limited, Lincoln, which is in liquidation, the liquidator, Sir William McLintock, reports that he has not yet been successful in disposing of the Abbey Works, despite negotiations in various directions. He as Receiver has been able to discharge the claims of the debenture holders amounting to about £110,000, and has paid the first dividend of 2s. in the £ on the claims of unsecured creditors.

International Combustion, Limited, Africa House, Kingsway, London, W.C.2, announce that their associated company in New York, the Combustion Engineering Corporation, has received an order from the Brooklyn Edison Company for eight boilers, each of 530,000 lbs. per hour evaporation at 500 lbs. pressure, complete with Murray fin-tube furnaces and fin-tube economisers. They will be fired by multiple retort underfeed stokers 26 ft. 6 in. wide by 27 ft. deep.

Sir Joseph Calvert has received a letter from the President of the Board of Trade with reference to his suggestion that much work might be found for the unemployed by producing pig-iron for stock, on the lines of the old warrant stores, against the revival of trade. The letter intimates that the Government had had a number of proposals put before them, which related not only to the iron and steel industries, but to the other staple industries of the country, and which all involved financial assistance by the State in one form or another. These proposals in any case would require legislation, and all the President could say for the time being in regard to Sir Joseph's scheme was that it had been carefully noted.

The Power Gas Economy Company, 50, Wellington Street, Glasgow, makers of "Hunter" gas burners and pressure regulators, announce the recent receipt of the following orders:—Stanton Ironworks Company, Limited, four burners; Edgar Allen & Company, Limited, for Synthetic Ammonia & Nitrates, Limited, one burner; Darwen & Mostyn Iron Company, Limited, 16 burners; Mines de l'Escarpelle, France, three burners; Nunnery Colliery Company, Limited, four burners; Mines de Courrières, France, four burners; Société Métallurgique de Hoboken, Belgium, one controller; Forges & Aciéries Huta-Bankowa, Poland, eight burners; Vapeur Force & Motrice, France, two burners; Babcock & Wilcox, Limited, for Mines et Fonderies de Zinc de la Vieille Montagne, Belgium, nine burners and six controllers.

On June 2 last, the Board of Trade made a direction to the effect that tools and implements covered by Part 4 of the Merchandise Marks (Imported Goods) No. 5 Order, 1929, imported before December 17, 1929, which are sold or exposed for sale before July 1, 1931, may bear an indication of origin applied to each article by means of a label securely attached, instead of being required to have the indication of origin applied by die-stamping or other mode of impressing. The question whether the Merchandise Marks (Imported Goods) No. 5 Order, 1929, should be amended, either in accordance with the terms of the direction or otherwise, having been referred to the Standing Committee appointed by the Board of Trade and representations having been received on the subject from certain interests concerned, the Committee will hold an inquiry into the matter at 11.30 a.m. on Monday, November 17 next. The inquiry will be held at the Board of Trade Offices, Great George Street, London, S.W.1. Any communications on the subject should be addressed to the Secretary, Mr. E. W. Reardon, at that address.

Reports and Dividends.

Tweedales & Smalley (1920), Limited.—Interim dividend of 2½ per cent.

Stothert & Pitt, Limited.—Profit, £28,221; to reserve, £10,000; dividend of 10 per cent.; carried forward, £5,643.

Drake & Gorham, Limited.—Net profit, £9,511; brought in, £3,040; dividend of 5 per cent.; to reserve, £2,500; carried forward, £3,802.

George Turton Platts & Company, Limited.—Net profit, £12,064; brought in, £4,420; ordinary dividend of 6¼ per cent.; carried forward, £7,934.

Hoffmann Manufacturing Company, Limited.—The directors propose to defer consideration of the payment of an interim dividend on the ordinary shares until the result of the year's trading is known.

Samuel Osborn & Company, Limited.—Net profit, £35,291; brought in, £21,945; preference dividends, £14,366; dividend of 7 per cent. on the ordinary shares; to reserve, £5,000; carried forward, £21,974.

Electrolytic Zinc Company (of Australasia), Limited.—Net profit for year to June 30 last, £283,015; brought in, £15,406; debenture sinking fund, £12,100; development, etc., £25,000; dividend of 10 per cent., absorbing £260,000; carried forward, £1,321.

Contracts Open.

Dumfries, November 3.—24,000 ft. of steel pipes, etc., for the Corporation. Messrs. Warren & Stuart, engineers, 94, Hope Street, Glasgow. (Fee £2 2s., returnable.)

Ely, Cambs, November 5.—Cast-iron water mains, for the Ely Rural District Council. Messrs. Silcock & Simpson, engineers, 25, Victoria Street, Westminster, London, S.W.1. (Fee £5, returnable.)

Casablanca, December 1.—Steam travelling-crane, for the Direction Générale des Travaux Publics. The Department of Overseas Trade. (Reference A.X. 10,406.)

London, E.C., November 4.—Nine locomotive boilers and cylinders, etc., for the Bengal and North Western Railway Company, Limited, 237, Gresham House, Old Broad Street, London, E.C.2. (Fee £1, non-returnable.)

London, E.C., November 18.—30 bogie carriages, for the Bengal and North-Western Railway Company, Limited, 237, Gresham House, Old Broad Street, London, E.C.2. (Fee £2, non-returnable.)

London, S.E., November 7.—Seven Z.B. type locomotives, for the India Store Department, Belvedere Road, Lambeth, London, S.E.1. (Fee 5s., non-returnable.)

Santiago, December 3.—Spare parts for rolling stock, for the Chilean State Railways Department. The Department of Overseas Trade. (Reference C.X. 3,382.)

Personal.

Mr. Oliver Smalley has been appointed director of research to the American Grey Iron Institute.

Captain H. J. Kennard, R.N., managing director of the Falkirk Iron Company, Limited, has been returned unopposed to the Middle Ward of the Falkirk Town Council.

Wills.

Atkinson, E. F., of Sheffield, steel manufacturer and merchant, of Messrs. Camm, Bagshaw & Company £7,718

Braime, J. H., joint managing director of Messrs. T. F. & J. H. Braime, Limited, Leeds £25,493

Sneddon, Andrew, manager of Messrs. Murray & Paterson, Limited, Coatbank Engine Works, Coatbridge ... £13,638

Obituary.

Mr. John Albert Thompson, of Messrs. Thompson Bros. (Bilston), Limited, engineers and tank manufacturers, died recently, aged 58.

Mr. P. B. Turnbull, a director of Messrs. Edward Curran & Company, Limited, Cardiff, manufacturers of enamelled steel hollow-ware, died on October 20.

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Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—So far as at present can be observed, there are no signs of improvement in home demands for Cleveland pig-iron, and markets continue quiet and inactive. It will, however, be understood that many consumers have already placed orders for their autumn requirements, and only in exceptional circumstances is extensive forward buying necessary to meet the ordinary needs of the foundry industry in such slack times as now prevail. Nevertheless, the Cleveland ironmasters would seem to have less need for anxiety than the makers in other areas. They have orders on the books sufficient to ensure the disposal of the current output, and, in fact, they are reducing stocks to some small extent. The most surprising development in the existing position of the trade is the increase in the export branch. This is quite unexpected in view of the low rates quoted for Continental iron, but the statistics of the Tees exports are incontrovertible, and these reflect a better outward flow of pig-iron than for several months past. Rather curiously, increased exports have synchronised with increased imports, a large order for Belgian iron having been placed by a local firm, of which delivery is now proceeding. The official fixed prices continue in force as usual, quotations ruling:—No. 1 Cleveland foundry iron, 66s. per ton; No. 3 G.M.B., 63s. 6d.; No. 4 foundry, 62s. 6d.; No. 4 forge, 62s. per ton, f.o.t. or f.o.b.

In the East Coast hematite market the more favourable conditions previously reported are still maintained, home consumers having taken better deliveries, and the improvement in the Tees exports of pig-iron is largely due to the bigger overseas sales. Thus makers have been able to reduce their stocks and to adhere fairly closely to a minimum of 71s. per ton for mixed numbers and 71s. 6d. for No. 1 quality. On the North-West Coast, Bessemer mixed numbers are firm at 70s. per ton at works.

LANCASHIRE.—In local markets for foundry pig business is still on a restricted scale, most consumers only buying to meet urgent needs, and then in moderate tonnages for prompt delivery. A notable recent development in Lancashire markets has been the resumption of Continental competition in foundry pig, who are offering this quality iron at prices cut by 6s. to 8s. per ton, but how far successful the invasion may prove remains to be seen. In the meantime, quotations are unaltered, with Derbyshire and Staffordshire No. 3 quality marked at 72s. per ton, delivered equal Manchester.

THE MIDLANDS.—In common with other districts, the local markets for foundry pig are experiencing a very moderate demand, most consumers complaining of the high prices current in the area, as comparing unfavourably with those quoted in other markets. There is, however, no movement on the part of the furnace owners to reduce the prices, which remain at 70s. per ton for Northants No. 3 and 73s. 6d. for Derbyshire and Staffordshire No. 3, delivered local stations.

SCOTLAND.—In the market for Scotch pig-iron, business remains within very narrow limits and has reached a point where further contraction hardly seems possible. So far as foundry iron is concerned, the making of contracts has almost ceased, but, notwithstanding this position, the makers maintain their price of 76s. 6d. for No. 3, f.o.t. furnaces.

Finished Iron.

This market continues extremely depressed, and the makers are able to work in a spasmodic manner only. The manufacturers of Staffordshire marked bars remain fairly well engaged, but this class of bar affects only two or three works. The works engaged in the manufacture of crown and nut and bolt iron are very badly situated. In the case of the latter, the chief trouble lies in the fact that Continental iron is cheap, and the bulk of the business now passing from this area is going to the foreign mills, which are taking £5 5s. to £5 10s., delivered locally, as compared with about £9 for the home quality. Staffordshire crown bars are quoted at about £10 per ton.

Steel.

In the Sheffield steel market the decision of the associated steelmakers to make no alteration at present in basis prices has had no effect on business. It was suggested that buyers had been holding off in the expectation that prices would fall, and that the decision of the makers being known, they would have to place business. So far this has not been the case, and buying in all sections has been on a very restricted scale. Acid billets are very quiet, and, although there is some business in basic billets, there is nothing approaching active demand. Continental competition in billets and rods is sharp, but, despite their comparative cheapness, business is only moderate. The output of open-hearth steel continues to shrink, and only about a third of the furnaces in this district are now operating. Crucible-steel demand does not improve, but makers of stainless and other special high-quality steels have heavy orders on their books. In the tinplate market, very little business is passing, with the quotation still ruling 17s. basis, net cash, f.o.b. Welsh ports.

Scrap.

Reports from the various centres of trade in scrap material give little hope of an early revival of demand, and business is generally slack all round. On Tees-side, for foundry scrap, prices are a shade weaker, heavy cast iron, ordinary quality, being quoted at 52s., and in the absence of any offers, machinery quality in handy pieces has been marked down to 53s. 6d. In the Midlands, the price obtainable for cast-iron scrap is better than for any other quality For machinery cast-iron scrap, broken into cupola sizes, 60s. to 65s. is offered, according to quality, with medium cast-iron scrap at 57s. 6d. and light metal at 47s. 6d. In Scotland, machinery cast iron is in slow demand, the nominal price being around 60s. to 62s. 6d.; heavy ordinary cast-iron scrap to the same specification is 54s. to 55s., steelworks cast iron around 50s., light cast iron 44s. to 45s., with firebars at 42s. 6d. Old cast-iron railway chairs are unchanged at 57s. 6d. to 58s. 6d. The above prices are all per ton delivered f.o.t. consumers' works.

Metals.

Copper.—Business in the markets for base metals during the past week has been again restricted in volume, and without any outstanding feature of interest. Demand, both at home and abroad, continues poor, and until consumption in the States and elsewhere improves to something like normal proportions, there appears little hope of a general recovery in markets. The dominating factor in the situation to-day is, of course, the huge reserves of refined copper, and probably the quickest way to reduce these would be to bring the price down to such a level that high-cost producers would be forced out of the running.

Closing quotations :—

Cash.—Thursday, £41 15s. to £41 17s. 6d.; Friday, £41 7s. 6d. to £41 8s. 9d.; Monday, £41 12s. 6d. to £41 13s. 9d.; Tuesday, £41 18s. 9d. to £42 1s. 3d.; Wednesday, £43 to £43 2s. 6d.

Three Months. — Thursday, £41 16s. 3d. to £41 17s. 6d.; Friday, £41 6s. 3d. to £41 7s. 6d.; Monday, £41 12s. 6d. to £41 13s. 9d.; Tuesday, £41 17s. 6d. to £42; Wednesday, £42 16s. 3d. to £42 17s. 6d.

Tin.—Though closing at the week-end with a weaker tendency, the tone in the standard tin market has been distinctly more cheerful, buying in America having certainly improved, but in Europe demand still leaves much to be desired. Estimates of the Straits' shipments for this month have been revised in a downward direction, while stocks in Liverpool and London have been drawn upon to some extent. Broadly speaking, the rise in values seems to be justified by the better outlook, but for the moment it has probably reached its zenith.

Official closing prices :—

Cash.—Thursday, £115 15s. to £116; Friday, £116 15s. to £117; Monday, £117 10s. to £117 15s.; Tuesday, £118 17s. 6d. to £119; Wednesday, £118 7s. 6d. to £118 10s.

Three Months.—Thursday, £117 5s. to £117 10s.; Friday, £118 5s. to £118 7s. 6d.; Monday, £119 to £119 5s.; Tuesday, £120 5s. to £120 7s. 6d.; Wednesday, £119 17s. 6d. to £120.

Spelter.—For a time during the past week values showed a much better tendency, the quotation being up 20s. at one period, but a reaction has followed. A meeting of zinc producers was held this week in Paris to discuss output restriction.

Daily fluctuations :—

Ordinary.—Thursday, £14 2s. 6d.; Friday, £14 5s.; Monday, £14 5s.; Tuesday, £14 3s. 9d.; Wednesday, £14 6s. 3d.

Lead.—A firmer tone has been in evidence in this market of late, the price at one time reaching £16, but reacting from the best. German demand has improved, but Russia has not figured as a buyer. American stocks showed some reduction last month.

The week's prices have been :—

Soft Foreign (Prompt).—Thursday, £15 10s.; Friday, £15 7s. 6d.; Monday, £14 5s.; Tuesday, £15 7s. 6d.; Wednesday, £15 10s.

Students' Corner.

Q.—What precautions should be taken, or what are the important points to remember, in connection with solid contraction?

(*Continued from page* 278.)

When stripping, covering, or baring castings to balance the contraction, great care and skill is necessary. Hard-rammed, strong, clayey sand, when dried, will sometimes offer sufficient resistance to easy contraction, so that the casting will rupture during the pasty-stage condition. This kind of rupture was brought home to the author when trying to solve problems regarding double-flanged cylindrical castings, and a large heavy fly-wheel. In both cases the rupture occurred during the pasty stage. In the flanged cylindrical casting, the rupture took place at the junction where the thin body of the pipe adjoined the much thicker flange. In the case of the fly-wheel, the rupture or rip took place at the root of the feeding stalk on the thick rim of the fly-wheel, *id est*, at the junction where the comparatively thin stalk adjoined the very thick rim of the fly-wheel. In the one instance, the comparatively thin body of the cylindrical casting had commenced to contract, but the strong, clayey hard-rammed milled sand underneath the flange (which was still in a pasty condition) prevented the flange following, hence the rupture.

In the case of the fly-wheel, the feeding stalk, which would freeze when the rim would be in the pasty stage, was actually prevented from contracting in the only way it could contract — which was towards the thick rim. Hence, again, the rupture at the root of the feeding stalk into the thick rim which was in the pasty condition. The cause of both of these contracting troubles was due to faulty and bad practice in the foundry. When the feeding stalk on the rim of the wheel, which was about 18 in. long, was impeded from following its normal contraction, hence it followed the line of least resistance by pulling out at its root to its own centre, some of the pasty-stage metal of the rim, leaving a hole and a slight fissure further into the rim. That was all that was the matter with the wheel, but it was sufficient to cause several to be scrapped.

Another precautionary measure regarding solid contraction is, when the dowcomers of runner-gates, or the stalks of risers, come close to box-bars, or any rigid substance, the sand should be eased from around them if the contraction of the casting is in that direction. With long castings, 15 or 20 feet long, having a contraction between 2 and 3 inches, it will be realised how important it is.

(*To be continued.*)

GREAT ECONOMY!

ONE of the greatest improvements you can introduce into your foundry is the STERLING ROLLED STEEL MOULDING BOX.

The result will be economy all round.

Your moulders will put down more moulds per day because STERLING BOXES are light and easy to handle;

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Manchester: F. L. HUNT & CO., Chapel Street, SALFORD, MANCHESTER.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	43	0	0
Three months	42	16	3
Electrolytic	44	5	0
Tough	43	5	0
Best selected	43	15	0
Sheets	73	0	0
India	56	15	0
Wire bars	45	5	0
Do. November	45	5	0
Do. January	45	5	0
Ingot bars	45	5	0
H.C. wire rods	46	15	0
Off. av. cash, September	46	6	0 27/44
Do., 3 mths. September	46	6	8 15/44
Do., Sttlmnt., September	46	6	0 3/11
Do., Electro, September	50	1	7 1/11
Do., B.S., September	49	7	6
Do., wire bars, September	50	13	7 1/11
Solid drawn tubes			11½d.
Brazed tubes			11½d.
Wire			7½d.

BRASS.

Solid drawn tubes	10d.
Brazed tubes	12d.
Rods, drawn	9½d.
Rods, extd. or rlld.	6d.
Sheets to 10 w.g.	8¾d.
Wire	8½d.
Rolled metal	7¼d.
Yellow metal rods	6d.
Do. 4 × 4 Squares	6¾d.
Do. 4 × 3 Sheets	7¼d.

TIN.

	£	s.	d.
Standard cash	118	7	6
Three months	119	17	6
English	119	15	0
Bars	122	0	0
Straits	124	7	6
Australian	121	17	6
Eastern	125	7	6
Banca	123	17	6
Off. av. cash, September	132	14	0 9/22
Do., 3 mths., September	134	6	11 3/11
Do., Sttlmt., September	132	14	1 1/11

SPELTER.

	£	s.	d.
Ordinary	14	6	3
Remelted	12	15	0
Hard	11	5	0
Electro 99.9	16	10	0
English	14	15	0
India	12	10	0
Zinc dust	20	0	0
Zinc ashes	3	10	0
Off. aver., September	15	18	5 13/22
Aver., spot, September	15	15	5 3/11

LEAD.

	£	s.	d.
Soft foreign ppt.	15	10	0
English	17	0	0
Off. average, September	17	17	0 3/22
Average spot, September	17	18	2 5/11

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	24	0	0
Do. V.M. ex-whf.	24	10	0
Rods	28	0	0
Boiler plates	20	0	0
Battery plates	21	0	0

ANTIMONY.

	£	s.	d.
Special brand, Eng.	36	0	0
Chinese	25	10	0
Crude	22	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	22	10	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£7 17 6
45/50%	£11 10 0
75%	£18 10 0
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% c. free	4/2 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	11¾d. lb.
Ferro-phosphorus, 20/25%	£16 0 0
Ferro-tungsten—	
80/85%	2/3 lb.
Tungsten metal powder—	
98/99%	2/6 lb.
Ferro-chrome—	
2/4% car.	£30 10 0
4/6% car.	£23 5 0
6/8% car.	£22 10 0
8/10% car.	£22 2 6
Ferro-chrome—	
Max. 2% car.	£32 17 6
Max. 1% car.	£37 15 0
Max. 0.70% car.	£41 0 0
70% carbon-free	11d. lb.
Nickel—99% cubes, or pellets	£175 0 0
Ferro-cobalt	9/7 lb.
Aluminium 98/99%	£85 0 0
Metallic chromium—	
96/98%	2/7 lb.
Ferro-manganese (net)—	
76/80% loose	£11 0 0 to £11 15 0
76/80% packed	£12 0 0 to £12 15 0
76/80% export	£10 10 0 to £11 0 0
Metallic manganese—	
94/96% carbonless	1/4 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0 2 2
Finished bars, 18% tungsten	£0 3 0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 7/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ½ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

South Wales—	£	s.	d.		£	s.	d.
Heavy steel	2	12	6	to	2	13	6
Bundled steel and shrngs.	2	7	6	to	2	10	0
Mixed iron and steel					2	7	6
Heavy cast iron					2	12	6
Good machinery for foundries	2	15	0	to	2	17	6

Cleveland—							
Heavy steel					2	5	0
Steel turnings					1	17	6
Cast-iron borings					1	10	0
Heavy forge					3	2	6
W.I. piling scrap					2	17	6
Cast-iron scrap	2	12	0	to	2	13	6

Midlands—							
Ord. cast-iron scrap					2	7	6
Heavy wrought	2	17	6	to	3	0	0
Steel turnings					1	5	0

Scotland—							
Heavy steel					2	10	0
Ordinary cast iron					2	14	0
Engineers' turnings					1	16	6
Cast-iron borings					1	15	0
Wrought-iron piling					3	5	0
Heavy machinery					3	0	0

London—Merchants' buying prices delivered yard.

Copper (clean)	37	0	0
Brass	26	0	0
Lead (less usual draft)	13	10	0
Tea lead	11	0	0
Zinc	7	10	0
New aluminium cuttings	51	0	0
Braziery copper	34	0	0
Gunmetal	38	0	0
Hollow pewter	80	0	0
Shaped black pewter	60	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	66/-
Foundry No. 3	63/6
Foundry No. 4	62/6
Forge No. 4	62/-
Hematite No. 1	71/6
Hematite M/Nos.	71/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	79/-
„ d/d Birm.	88/6
Midlands—	
Staffs. common*	—
„ No. 4 forge*	68/6
„ No. 3 fdry.*	73/6
Shrops. basic	—
„ Cold blast, ord.	—
„ „ roll iron	—
Northants forge*	65/-
„ fdry. No. 3*	70/-
Derbyshire forge*	68/6
„ fdry. No. 3*	73/6
„ basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	79/-
„ No. 3	76/6
Hem. M/Nos.	77/-
Sheffield (d/d district)—	
Derby forge	63/6
„ fdry. No. 3	68/6
Lincs. forge	—
„ fdry. No. 3	70/-
E.C. hematite	83/6
W.C. hematite	86/6
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	67/-
„ fdry. No. 3	72/-
Staffs foundry No. 3	72/-
Dalzell, No. 3 (special)	105/- to 107/6
Summerlee, No. 3	92/-
Glengarnock, No. 3	—
Eglinton, No. 3	92/-
Gartsherrie, No. 3	92/-
Monkland, No. 3	92/-
Shotts, No. 3	92/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	10	0	0	to	10	15	0
Nut and bolt iron					9	0	0
Hoops	10	15	0	to	12	0	0
Marked bars (Staffs) f.o.t.					12	10	0
Gas strip	10	15	0	to	12	0	0
Bolts and nuts, ¾ in. × 4 in.					15	5	0

Steel—							
Ship plates	8	15	0	to	8	17	6
Boiler plts.	9	10	0	to	10	10	0
Chequer plts.					10	12	6
Angles					8	7	6
Tees					9	7	6
Joists					8	10	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ¾ in. (Untested)					7	12	6

and upwards

Flats—8 in. wide and over	8	12	6
„ under 8 in. and over 5in.	8	17	6
Rails, heavy	8	10	0
Fishplates	12	0	0
Hoops (Staffs)	9	5	0 to 9 10 0
Black sheets, 24g.	9	5	0 to 9 15 0
Galv.cor.shts., 24g.	11	12	6
Galv. fencing wire, 8g. plain	12	0	0
Billets, soft	5	12	6 to 6 5 0
Billets, hard	7	10	0 to 8 0 0
Sheet bars	5	12	6 to 5 15 0
Tin bars	5	15	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1/-
Sheet to 10 w.g.	1/0½
Wire	1/0⅝
Rods	1/0½
Tubes	1/5¼
Castings	1/1

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	8d. to 1/2
Rolled—	
To 9 in. wide	1/2 to 1/8
To 12 in. wide	1/2¼ to 1/8¼
To 15 in. wide	1/2½ to 1/8½
To 18 in. wide	1/3 to 1/9
To 21 in. wide	1/3½ to 1/9½
To 25 in. wide	1/4 to 1/10
Ingots for spoons and forks	8d. to 1/4½
Ingots rolled to spoon size	11d. to 1/7½
Wire round—	
3/0 to 10 G.	1/5½ to 2/0½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	18.76
No. 2 foundry, Valley	17.00
No. 2 foundry, Birm.	14.00
Basic	18.76
Bessemer	19.76
Malleable	19.76
Grey forge	18.76
Ferro-mang. 80%	94.00
O.-h. rails, h'y, at mill	43.00
Billets	31.00
Sheet bars	31.00
Wire rods	36.00
	Cents.
Iron bars, Phila.	2.09
Steel bars	1.60
Tank plates	1.60
Beams, etc.	1.60
Skelp, grooved steel	1.60
Skelp, sheared steel	1.70
Steel hoops	1.95
Sheets, black, No. 24	2.35
Sheets, galv., No. 24	3.00
Sheets, blue an'l'd, No. 13	2.05
Wire nails	2.00
Plain wire	2.30
Barbed wire, galv.	2.70
Tinplates, 100-lb. box	$5.00

COKE (at ovens).

Welsh foundry	25/- to 27/6
„ furnace	16/- to 18/-
Durham and Northumberland—	
„ foundry	14/6 to 15/-
„ furnace	14/6
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 box		17/-
„	28×20 „		34/-
„	20×10 „		24/6
„	18¾×14 „		17/9
C.W.	20×14 „		15/6
„	28×20 „		32/-
„	20×10 „		23/6
„	18¾×14 „		17/-
Terneplates	28×20		31/- per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6	0	0	to	£7	10	0
Bars, hammered, basis	£17	10	0	to	£18	10	0
Bars and nail-rods, rolled, basis	£15	17	6	to	£16	15	0
E.ooms	£10	0	0	to	£12	0	0
Keg steel	£32	0	0	to	£33	0	0
Faggot steel	£20	0	0	to	£24	0	0
Bars and rods dead soft, steel	£11	0	0	to	£14	0	0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.

Over ½ in. up to 6 in.

	Tubes.	*Fittings.*
Gas	62½%	47½%
Water ..	58½%	42½%
Steam ..	55%	37½%

W.I. 12½% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.	
Oct.	23 ..	41	15	0	dec. 18 9
,,	24 ..	41	7	6	,, 7/6
,,	27 ..	41	12	6	inc. 5/-
,,	28 ..	41	18	9	,, 6/3
,,	29 ..	43	0	0	,, 21/3

Electrolytic Copper.

		£	s.	d.	
Oct.	23 ..	45	0	0	dec. 15/-
,,	24 ..	44	0	0	,, 20/-
,,	27 ..	44	5	6	inc. 5/-
,,	28 ..	44	5	0	No change
,,	29 ..	44	5	0	,, ,,

Standard Tin (cash).

		£	s.	d.	
Oct.	23 ..	115	15	0	dec. 65/-
,,	24 ..	116	15	0	inc. 20/-
,,	27 ..	117	10	0	,, 15/-
,,	28 ..	118	17	6	,, 27 6
,,	29 ..	118	7	6	dec. 10/-

Tin (English ingots).

		£	s.	d.	
Oct.	23 ..	116	15	0	dec. 75/-
,,	24 ..	118	0	0	inc. 25/-
,,	27 ..	118	15	0	,, 15/-
,,	28 ..	120	0	0	,, 25/-
,,	29 ..	119	15	0	dec. 5/-

Zinc Sheets (English).

		£	s.	d.	
Oct.	23 ..	24	0	0	No change
,,	24 ..	24	0	0	,, ,,
,,	27 ..	24	0	0	,, ,,
,,	28 ..	24	0	0	,, ,,
,,	29 ..	24	0	0	,, ,,

Spelter (ordinary).

		£	s.	d.	
Oct.	23 ..	14	2	6	dec. 6/3
,,	24 ..	14	5	0	inc. 2/6
,,	27 ..	14	5	0	No change
,,	28 ..	14	3	9	dec. 1/3
,,	29 ..	14	6	3	inc. 2/6

Lead (English).

		£	s.	d.	
Oct.	23 ..	17	0	0	dec. 5/-
,,	24 ..	16	15	0	,, 5/-
,,	27 ..	17	0	0	inc. 5/-
,,	28 ..	16	15	0	dec. 5/-
,,	29 ..	17	0	0	inc. 5/-

AVERAGE MONTHLY PRICES OF MARKED BARS (SOUTH STAFFS).

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1897	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0
1898	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	8 0 0	8 0 0	7 11 8
1899	8 0 0	8 0 0	8 0 0	8 0 0	8 10 0	8 10 0	9 0 0	9 0 0	9 10 0	10 0 0	10 0 0	10 0 0	8 8 4
1900	11 0 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 5 10
1901	9 10 0	9 10 0	9 10 0	9 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 16 8
1902	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 7 6
1903	8 5 0	8 5 0	8 5 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 8 9
1904	8 10 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 10
1905	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 10 0	8 10 0	8 1 8
1906	8 10 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	8 10 0	8 10 0	8 10 0	8 10 0	9 0 0	8 15 10
1907	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0
1908	9 0 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 5 10
1909	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0
1910	8 0 0	8 0 0	8 0 0	8 0 9	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0
1911	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0
1912	8 10 0	8 10 0	8 10 0	8 15 0	9 0 0	9 0 0	9 0 0	9 8 0	9 10 0	9 10 0	9 10 0	9 15 0	9 1 6
1913	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	9 10 0	9 10 0	9 4 0	9 0 0	9 0 0	9 13 8
1914	8 12 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	8 14 4
1915	9 0 0	9 0 0	9 3 0	10 2 0	10 15 0	11 10 0	12 0 0	12 0 0	12 0 0	12 7 6	12 10 0	13 10 0	11 5 0
1916	13 10 0	13 10 0	14 13 0	15 0 0	15 0 0	15 0 0	15 0 0	15 10 0	15 10 0	15 0 0	15 10 0	15 0 0	14 18 7
1917	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0
1918	15 12 6	16 0 0	16 0 0	16 0 0	16 0 0	16 0 0	16 0 0	16 0 0	16 0 0	17 0 0	17 0 0	17 0 0	16 6 3
1919	18 0 0	18 10 0	20 0 0	20 0 0	23 0 0	23 0 0	23 0 0	24 12 0	25 0 0	25 0 0	25 0 0	25 5 0	22 10 7
1920	26 17 6	27 0 0	28 0 0	30 5 0	30 10 0	33 10 0	33 10 0	33 10 0	33 10 0	33 10 0	33 10 0	33 10 0	31 10 2
1921	31 10 0	30 3 4	27 10 0	27 10 0	27 10 0	24 15 0	21 0 0	20 0 0	20 0 0	17 10 0	17 0 0	16 0 0	23 7 4
1922	16 0 0	14 17 6	14 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 18 1½
1923	13 10 0	13 10 0	13 16 0	14 7 6	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 5 3½
1924	14 10 0	14 10 0	14 10 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	14 17 6	14 17 3½
1925	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 0 0	14 13 4
1926	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	—*	14 10 0	14 0 10
1927	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 0 0	13 0 0	12 18 0	13 15 8
1928	12 10 0	12 10 0	12 10 0	12 2 6	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 2 6½
1929	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 7 6	12 10 0	12 10 0	12 2 3½
1930	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	—	—	—	—

* No quotation available.

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